PUBLIC WORKS IN INDIA

EDN. 3

A.T. COTTON

MADRAS
1885

PUBLIC WORKS IN INDIA:

THEIR IMPORTANCE WITH
SUGGESTIONS FOR THEIR EXTENSION AND IMPROVEMENT,

BY

GENERAL SIR A. T. COTTON, R.E., K.C.S.I.

THIRD EDITION

WITH AN INTRODUCTORY CHAPTER ON THE GODAVERY WORKS,

BY

MAJOR-GENERAL J. F. FISCHER, R.E.,

TOGETHER WITH THE

Minutes of Evidence taken before the Select Committee
in June 1878, on Public Works in India.

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ADVERTISEMENT.

"It is the solution of what has always been considered a most "difficult and intricate problem, it sheds a flood of light over the "dark future of our Indian possessions, and, while scarcely yielding "in cogency of argument to Mathematical demonstration, arrives "at results at once practical and scientific,—at once of general "truth and immediate usefulness. Such as it is, we not only "earnestly commend it to the study of young and old India, of "Presidents and Directors, but of every English gentleman, who "wishes to understand how the resources of modern science may be "brought to bear on the happiness of individuals and communities, "and how those principles, which every one is anxious to apply to "his own estate, may be used for the regeneration of a mighty "empire."—"*Times*," *December* 28*th*, 1853.

PUBLISHER'S PREFACE.

As public attention, both in England and here, is once again being directed to the vital importance of Irrigation and Navigation Works to the material improvement of this country, we reproduce, at the suggestion of several gentlemen connected with the Government Service, General Sir Arthur Cotton's treatise on Public Works in India originally written for private circulation and published in London in January 1854. This edition is a *verbatim* reprint of the Madras revised edition of March of the same year, to which we have added an Introductory chapter on the Godavery Works by Major-General J. F. Fischer, R.E., and an Appendix containing Sir Arthur Cotton's evidence before the Parliamentary Select Committee of 1878 on East Indian Public Works. Sir Arthur Cotton's large experimental acquaintance with the subject of which he treats, his long residence in India of upwards of thirty-four years, and his intimate connection with Irrigation Works in several Districts of this Presidency, give great weight to the views enunciated by him, the correctness of which subsequent experiences so fully confirm.

H. & Co.

February 1885.

PREFACE

TO THE

INDIAN EDITION.

The following work has been undertaken under an urgent sense of the importance, at this crisis, of a right understanding of the principles upon which the material improvement of India should be conducted. Our responsibility for the just and judicious development of the resources of the country is now generally acknowledged: but it is not so clear that we have yet perceived and entered upon the right path to accomplish that object. A great system of railways has been projected, not after investigation of the specific condition, resources and wants of the different provinces and districts, but, it would appear, rather as a sort of infallible means of improvement, adapted *à priori* to this country as to every other. This may be ascribed in a considerable measure to the total absence of popular action in the country. In England and America, and other countries possessing effective Municipalities, improvements are projected chiefly by those who, being immediately interested in them, can fully comprehend their relative value and importance, and cannot be deceived by theories contradicted by their own knowledge and experience. It is therefore of great importance that in India, the voice of whose millions of inhabitants on subjects most nearly concerning their welfare is never uttered, or is at least inaudible, those friends of India who have reason to believe from the peculiar circumstances in which they have been placed, that they understand the country and its peculiar wants, should do their part to direct into the right channel the thoughts and plans of the authorities whose decision is absolute: for the best intentions will never supply the place of just ideas.

What pretensions the writer has to offer advice and instruction on these subjects, will appear from the following pages; but whatever may be the value of his investigations, he has been actuated

by a sincere desire to build them upon undoubted truth, and to conduct them to true results. It is only right to add that a work composed amidst the numerous distractions of very onerous public duty will necessarily be found to contain many faults, which more leisure might have enabled the author partly to correct; but though the composition has been hurried, the matter is the fruit of anxious thought and study, extending over many years of experimental acquaintance with the subjects treated of. The work is therefore given to the public with a confidence in the soundness of its principles and conclusions, which mature consideration may entitle the author to entertain.

Since the first part of these papers was written, what a change has taken place in the prospects of India! Who would have thought a year ago that England would take such an interest in her affairs, and that such fundamental changes should be made in the constitution of her Government, fairly opening the door to every improvement, and loudly demanding of every real friend of India, that he should put forth all his energies, encouraged by the hope, the certainty, that with God's blessing we shall no longer labour in vain? The battle has been fought and won, especially in respect of Public Works. The Madras Public Works Report is like the last general advance at Waterloo. Henceforth the chief difficulty will be to discern friends from foes, for the latter will have no choice, but to hurry on in the same direction as the former; their only safety will be in moving at the same speed, and if any hesitate, they will only be trampled under foot. Already we see unmistakeable evidences of this; and very shortly both parties will be seen intermixed and swept along in one mass. If any from fool-hardiness or from not yet perceiving how the matter has really gone, attempt to make a stand, their efforts will scarcely have even a momentary effect, and will certainly bring upon themselves destruction. The tide of Indian improvement has now fairly set in, and woe be to him who attempts to stem it.

The writer would not have it supposed that he means these papers to be put forward as any attempt at an actual construction; he only offers them as containing *materials*, which, in common with many other persons, he has been collecting during thirty years of conflict, often apparently hopeless. It is to be hoped that some Solomon, some man of peace, will now appear to construct this temple of peace for India. The time has now arrived for the application of these and other materials to the actual building, and all who have

materials in their possession, should place them at the public disposal.* The author, on his part, feels like an old soldier after a long battle, sitting down quietly in the enemies' position and in the midst of the slain, to eat his rice and talk over the incidents of the day, in the full assurance that the enemy are irrecoverably overthrown; leaving it to his younger companions who are in pursuit, to scatter the debris of the broken columns, and waiting for the accounts they bring in from time to time as they return, of the dispersion and destruction of those fugitives, who from exhaustion or infatuation, were found in the way of the pursuers.

* Already we have several most important contributions from the hearty friends of India. The Madras P. W. Report,† Mr. Norton's "Madras," and Mr. Mackay's Western India especially, should be thoroughly digested by those who are really anxious that England should do her duty and improve the privilege offered to her, of giving India a share of her own advantages.

† Parliamentary Paper, No. 407—1 of 1853.

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8 Pice to a Penny.			1 Anna	=	$1\frac{1}{2}d.$
1 Pie	=	$\frac{1}{8}d.$	$1\frac{1}{4}$,,	=	$2d.$
2 ,,	=	$\frac{1}{4}d.$	$1\frac{1}{2}$,,	=	$2\frac{1}{4}.$
3 ,,	=	$\frac{3}{8}d.$	$1\frac{3}{4}$,,	=	$2\frac{1}{2}d.$
4 ,,	=	$\frac{1}{2}d.$	2 ,,	=	$3d.$
5 ,,	=	$\frac{5}{8}d.$	$2\frac{1}{2}$,,	=	$3\frac{3}{4}d.$
6 ,,	=	$\frac{3}{4}d.$	3 ,,	=	$4\frac{1}{2}d.$
7 ,,	=	$\frac{7}{8}d.$	1 Rupee	=	2*s*.
8 ,,	=	1*d*.	12 Pice	=	1 Anna.
			16 Annas	=	1 Rupee.

100,000 Rupees = 1 Lack = £10,000.
100 Lacks = 1 Crore = £1,000,000.
1 Cawnie = 57,600 sq. ft. = 6,840 sq. yards = 1·32,2316 Acres.
1 Acre = 43,560 sq. ft. = 4,840 sq. yards = 0·75625 Cawnies.
640 Acres, or 484 Cawnies = 1 sq. mile.

PUBLIC WORKS IN INDIA.

INTRODUCTION.

THE GODAVERY WORKS.

> " Bacon, like Moses, led us forth at last,
> The barren wilderness he past,
> Did on the very border stand
> Of the blest promised land ;
> And from the mountain top of his exalted wit
> Saw it himself, and shewed us it."
>
> COWLEY.

HAVING been associated with Sir A. Cotton during all my service in India, in Public Works, and enjoying that distinguished officer's entire confidence and approval, I have, with his permission, undertaken to add this chapter to his invaluable work, to illustrate how the principles so ably advocated in his book, have been applied in practice, to secure permanently the welfare and prosperity of a district and its population.

Various opinions, official and un-official, as to the results of the Godavery Works, have appeared during the last thirty years, it would be tedious and unprofitable to examine or combat any of these, I propose to write a plain didactic account from the best original documents I have been able to obtain, to show the condition of the district at the time the works were proposed, and the circumstances which induced the Government of the day to advocate so strongly their construction immediately: in conclusion, I will also endeavour to shew as well as I can the present condition of the Godavery District, as compared with the other districts of the Madras Presidency, taking into special account the effects in them of the late Famine of 1876-78, as the Godavery Works were specially sanctioned to avert the recurrence of these horrors and losses in that district; these are all public matters of the greatest and most serious importance, and in giving an account of them, as succinctly as possible, I beg to say at the outset I have nothing to do with advocating any systems of administration; men who are hampered with upholding systems as specially belonging to their party or caste, always lose sight of facts and first principles.

On the 5th August 1844 the Board of Revenue, Madras, through their Secretary in the D. P. W., wrote as follows to Sir Arthur Cotton :—

1. "The Board of Revenue direct me to request that in lieu of a Diary, you will be so good as to furnish a general Report on the actual state of the Irrigation of your Division, and its capabilities of improvement, more especially as connected with the Godavery and other rivers which flow through it."

* * * * *

3. "The Board are desirous to take advantage of the present season to derive from your experience and knowledge; and they believe that it is necessary that a general system should be determined and acted upon, &c., &c."

In a first Report on the Irrigation of the Godavery District, dated the 12th August 1844, Sir A. Cotton, having anticipated the wishes of the Board, at once pointed out that "The principal part of this district forms the Delta of the Godavery, and as respects soil, climate and capabilities of irrigation, it can scarcely be surpassed by any part of the world. Such tracts as this, with their immense natural advantages, yet absolutely require the following *four* kinds of works, before their resources can be in any good degree developed. Even though favoured with a good supply of local rains in general, as is the case with this Delta, probably not one-fourth of the produce of which they are capable, can be obtained by means of local improvements of villages on a small scale, without the aid of the main works now enumerated :—

1*st.*—The embankment of the rivers to secure the crops from destruction by the river floods.

2*nd.*—Dams, with channels of irrigation leading from the river, to bring its waters from the level of its bed to that of the surface of the land.

3*rd.*—Surplus channels, to lead off the floods, caused by the local rains, from flat lands to the sea.

4*th.*—Raised roads and bridges to allow of the conveyance of produce to the markets, and to the coast through a country which is otherwise, from its nature, impassable during the rains.

"It needs no argument to convince that, without these means of counteracting the irregularity of the natural supplies of water, and of providing for the removal of the produce from where it is grown, to the places where it is required for consumption, or exportation, only a small portion of what the tract is capable of producing can be secured. One year the river floods overflow and destroy the greater part of the produce; another year the crops are lost from the river not rising high enough to supply the existing irrigating channels, though during the *worst* seasons, it carries uselessly to the sea water enough to irrigate ten times the extent of land in its Delta; in some seasons the local rains

flood all the lower lands, so that the crops are entirely lost; in others the failure of these rains destroy the crops over three-fourths of the same area, whilst not an acre of land need be dependent at all on the rainfall; and lastly, when the harvest is most abundant, it is of little use as there are no means of conveying it at any *moderate expense*, and at *the proper time*, to the point where there is a market for it."

"Of all these four works, the Godavery District has been hitherto, and is now wholly destitute. It is entirely without any general system of irrigation, drainage, embankments, or communications. There are some partial works of this kind, but they are of small extent, and even these have not been kept in an effective state." An examination of the few large irrigating channels in existence by actual levelling shewed these to be "radically defective." "Their beds are so much higher than that of the river, that they only admit water in the high freshes; and hitherto they have been without head sluices, so that the crops dependent upon them might be at one time perishing from drought, though there was an immense body of water in the river, and at another drowned by the floods, they conveyed to them, and not those lands only, but all the neighbouring country also." It will be as well to note here that most of the native proprietors, holding lands under these same channels under such precarious conditions, have been exempted paying the water-rate for the anicut water, on the ground that their lands received the river water before these works were constructed! They now get this water without fail every year, and mature all their crops in perfect security and certainty, and by means of the navigable canals, can dispose of all their produce to the best advantage; yet these very men, who it will be seen further on in the Government Orders had, by their apathy and negligence, brought the greatest misery and ruin on the district and its population, are now let off almost scot-free, though the works so benefiting to them have been paid for out of the taxes of all India.

Such then was the condition of this unhappy district at *that* time as regards its requirements of Public Works. The condition of its Revenue and its population are described as follows: this also is fully confirmed by the Collector of the time and all other authorities of the day:—

"I have not yet received a statement of the Revenue of the district from the time it came under our Government, but in the last ten years I find it has fallen off about five lacks; while the population, if the returns are correct, has fallen from 740,000 in 1821, to 560,000 in 1842, or one-fourth in twenty-one years," and this had actually occurred in a district possessing a Delta which for soil, climate, rainfall and natural river advantages, could not be surpassed by any part of the world, for raising food and other agricultural products with perfect certainty, and conveying these to markets and ports by water carriage, the cheapest mode

of conveyance for all articles of great bulk and weight, and of little value in their raw state.

In his Report, dated 25th February 1846, on Sir A. Cotton's proposal for the district, the Collector, Mr. T. Prendergast, says, para. 15:—

"The annexed statement gives the annual Revenue of the Province for the last forty years and exhibits a gradual falling off in the resources of the district:"

No.	Fuslies.	Amount.	
		RS.	
1	1215	20,84,048	*N.B.*—The highest was in 1243, Rs. 26,73,844, and the lowest in 1249, Rs. 17,22,318. The average for the period being Rs. 21,98,081, from *all* sources; and a glance at this table is quite sufficient to shew how very inelastic and precarious this Revenue was, no sooner was the screw put on tightly in any year on account of any natural favorable circumstances than in the next, it had to be relaxed leaving the ryots in a chronic, hopeless state of arrears, utterly incapable of making any improvements.
2	1216	20,48,104	
3	1217	21,49,579	
4	1218	20,43,322	
5	1219	21,44,300	
6	1220	25,89,850	
7	1221	21,06,493	
8	1222	26,49,522	
9	1223	23,91,442	
10	1224	22,73,593	
11	1225	18,69,569	
12	1226	23,69,512	
13	1227	23,42,326	
14	1228	23,42,043	
15	1229	22,49,126	
16	1230	21,47,641	
17	1231	22,87,446	
18	1232	22,46,941	
19	1233	21,85,221	
20	1234	25,76,970	
21	1235	23,41,323	
22	1236	25,09,240	
23	1237	23,62,184	
24	1238	24,86,468	
25	1239	23,41,036	
26	1240	23,57,544	
27	1241	20,77,801	
28	1242	19,08,883	
29	1243	26,73,844	
30	1244	26,39,465	
31	1245	19,58,892	
32	1246	21,54,815	
33	1247	21,41,490	
34	1248	17,26,809	
35	1249	17,22,318	
36	1250	17,42,130	
37	1251	21,08,336	
38	1252	19,62,753	
39	1253	17,33,965	
40	1254	21,83,448	J. F. F.

In para. 21 the Collector goes on to say, "Major Cotton estimates the probable diminution of the Revenue, if the proposed anicut is not built at Rs. 90,000 per annum being the amount of falling off, in a comparison of the present Revenue with what it was twenty-one years ago, and if the causes to which I have endeavoured to trace this diminution are, *as I believe them to be correct*, there seems no ground on which to build our hopes, that under present circumstances the resources of the Province will improve. All the causes of the failure of these resources, with the exception of the nature of the seasons, are lasting; and even as regards the seasons, it would not be one or two favorable seasons that would revive the means of the ryots. The old balances standing against many villages would fully absorb any amount of extra profits with which one or two plentiful harvests might supply the cultivators, the collections would be swelled without benefit to the people, and the returning cycle of unpropitious seasons would find them still unable to meet the demands against them, and the resources of the Province would have received no permanent or lasting improvement." What an admission to make of the fruits of the system of merely collecting land-revenue in India and so promoting the welfare and happiness of its population!

This Revenue Officer says, para. 40: "Two facts are undeniable, one, that the Delta of the Godavery, rich and fertile as its soil may become with the assistance of water, is comparatively poor and barren; the other that the Godavery bears annually to the sea, the means of fertilizing the whole country;" previously he had said, para. 39: "I am unwilling in any way to lessen the warmth of the support I am desirous of giving to the project by constantly recurring to minute differences which are after all of no consequence to the general question." It is much to be regretted that such public spirit as this no longer exists in Madras, the most frivolous pretexts which the smallest minds can suggest being eagerly seized upon to prevent anything being done for the benefit of the country, or to improve the condition of its impoverished population. Of the means at Sir A. Cotton's disposal to investigate this great undertaking, the accompanying extract gives a curious idea, and enables one to judge how Public Works were looked upon in those days, and it cannot be said any improvement has since taken place judging from the condition of Irrigation Works in all the districts of Southern India, including also Mysore:

"I have pointed out the necessity of sending great additional help to enable me even to prepare proper reports and estimates for the Godavery alone. The Board now call for reports and projects for the whole of these districts. I beg respectfully to express my conviction of the utter impossibility of doing anything worth mentioning with my present department, even in conducting the ordinary business of the division, much less in examining the various rivers, to ascertain the best mode of making use of them. The Assistant appointed has been ordered to take

charge of those works at Vizagapatam, but even if wholly freed of that charge, he could do little at first towards the present objects, being newly arrived, and without any knowledge of irrigation. There is only one instrument belonging to the division, and the senior of the *two* Sub-Assistant Surveyors has just written, to say that he cannot adjust it, and can do nothing in consequence; and I have no means of supplying him with another!" "This is the present state of a department in charge of works upon which about twenty lacks of rupees of Revenue depend, and upon which there might be a Revenue of double that amount depending, and where everything is in such a state of ruin, that a most decided effort is required to restore the districts to prosperity." The effects of the late famine in Madras shew that all the districts of the Presidency had been allowed to remain in this disastrous state of ruin, and nothing whatever has yet been done to prevent, or even to mitigate the recurrence of such horrors.

The above extracts give very briefly the opinions of the local officers who were concerned in preparing this great project; when submitted to the Board of Revenue, it was fully approved of and supported by them, and transmitted to the Government of the day, the late Marquis of Tweedale's, who recorded thereon, as follows, under date, the 1st September 1846:—

2. "This great undertaking appears to have been projected with the utmost care and circumspection: the professional member of the Board of Public Works has given his unqualified approval to the plan, while the importance of the object, so fully shown in Major Cotton's Reports, is acknowledged and dwelt on by the Collector of the district, and has obtained from the Board of Revenue a strong and unanimous opinion in favour of the project."

3. "In the Extracts of Minutes of Consultation, dated the 14th April 1844, a copy of which was furnished to the Court of Directors, in a letter of the same date, the Government had, under examination, the general state of this district, as brought to their notice in the Reports of the Board of Revenue and the Commissioner of the Northern Circars, and entered upon a review of the causes which led to the deterioration of the Revenues, and to the depressed state of the ryots; and it appeared from Sir H. Montgomery's inquiries that the total neglect of the works of irrigation under the zemindary system, the apathy displayed by the zemindars towards the improvement of their estates, and the evils attending the temporary and partial management of the local Revenue Officers, were amongst the chief causes of the impoverishment of a Province in which nature has bestowed so many advantages in soil and situation."

* * * * *

7. "One other point affords the strongest of arguments in favour of Major Cotton's project, that is, the frequent visitations of famine with which the Godavery District has been afflicted, and from which the

inhabitants have so dreadfully suffered; and if, as there is reason to believe, the proposed anicut will preserve the population of that Province from this frightful scourge, there cannot be a question that its construction should be advocated * * and the estimate strongly recommended, for immediate sanction."

I have made the extracts from all this correspondence as briefly as possible, to shew the wretched condition of the district and its population; the neglect and apathy of all the native proprietors; the ruinous state of all the old native works of irrigation; the inelastic and deplorable condition of the Revenue, collected with difficulty and always most oppressive, leaving the population in the best seasons utterly unable to clear off the arrears against them, and in any bad seasons falling off over 30 per cent. in the collections; and that this state of affairs was fully known to, and acknowledged by, all the authorities of the Presidency, who, one and all, heartily joined in supporting this great project, entirely approving of the principles and measures proposed by Sir A. Cotton for making a vigorous effort to efface such a disgraceful state of affairs from the records of our administration, so as to secure permanently the interests of the State, and the welfare and prosperity of a large population, which, with such abundant means at hand, had been allowed to sink into the most wretched state of ruin, misery, and hopelessness, so plainly acknowledged by the Government of the day, notwithstanding all the efforts made by the Revenue official, by every system of merely collecting land-revenue; the most deplorable exhibition of imbecility the history of the whole world affords a spectacle of.

The anicut was sanctioned and commenced to be built early in 1847, it would be of little use to give particular details of all the difficulties which had to be overcome in carrying out such a work across a river 4,000 yards wide at the site, and in which the floods rose thirty feet above summer level, in a district where skilled labour was quite unknown, and the people so fearful of a white man, they could not believe they would be honestly paid and not mal-treated. In June 1848 Sir A. Cotton had to proceed on sick leave, his health having been quite shattered by constant anxiety, exposure, and devotion to his work and duties, but the work was proceeded with to completion in 1850 under the zealous, faithful, and skilful supervision of the late Lieut.-General C. A. Orr, R.E., than whom a better officer never served any Government, and who here acquired that maturity of judgment, experience, and professional knowledge, which enabled him a few years later to construct the stupendous dam across the Kistnah River, without let or hindrance of any sort or kind; a work which he was specially selected to execute by Sir A. Cotton, at whose disposal the Government had placed the appointment when that project was sanctioned.

It was very soon seen that the estimate for the Godavery anicut was quite insufficient, and a Committee of Engineer and Revenue Officers

were appointed by the Government to report on all matters, and they thus conclude their Report:

73. "The Committee reviewing their inspections and investigations, are constrained to record their very high opinion of the science, ability and indefatigable labours of Major Cotton, displayed in the great work under report. It is scarcely possible to place that officer's qualifications as an Engineer of Hydraulic Works higher than they stood before; but the Godavery anicut is a new and splendid illustration of the powers of mind and self-devotion, from the exercise of which the country has already so largely benefited."

74. "The Committee, in submitting their Report, beg leave to add their recommendation, that the works may be prosecuted with all possible diligence."

This is a sufficient reply to all those who have pretended that Sir A. Cotton urged the Government to construct a work at reckless expense, merely to gratify his craving for expenditure on crude projects, as this Report was compiled in his absence by officers all junior to himself, whose public spirit is thus shewn to be above all suspicion.

Sir A. Cotton appears to have returned to duty in September 1850, and he was able to report that in the channels then supplied with water, the increase of Revenue was from 40 to 100 per cent. for the outlay on them: that the cost of transport would be reduced from four and a half rupees a ton for thirty-five miles by land carriage, to four annas a ton for the same distance, by water, thus saving 95 per cent. in the transit of all products by the works; and that the ryots were eagerly availing themselves of the means provided for them by the Government. The Collector was of opinion "that no Revenue management could have effected the great improvements in this district without the expenditure and the water," and to shew further the benefits of a navigable canal in such a tract of country Mr. Prendergast says in another Report:—

"The transit from Rajahmundry and its neighbourhood to the coast in past times was never attempted during the season when the Godavery freshes came down. During those four months *all* the communications were interrupted. But now the Thooliah Bagah affords a rapid and easy means of access to the coast, and is therefore of the utmost utility when the rivers are full and impassable."

So far the success of the project was assured and the soundness of the principles on which it was based fully demonstrated, when about 1851-52 the Board of Revenue directed, at the instance of the Sub-Collector, Mr. G. N. Taylor, late of the Madras Civil Service, that no water-rate was to be collected in future till a Revenue Survey and Settlement was made; this was not completed till 1866; and then all the native proprietors were specially exempted from its operations. When a water-rate was fixed, after a lapse of fifteen years, it was made 50 per cent. lower than the District Revenue Officers said the land was

quite able to pay, with such facilities of irrigation and navigation as these works afforded, and the certainty with which all crops could be raised and disposed of every season by their aid. The native proprietors, whose apathy and negligence had, as the Government declared in 1846, spread misery and destitution all around them, were mostly let off paying even this moderate water-rate, or allowed to commute for a mere nominal sum, on the plea that their lands had received water from the river before the works were constructed, in utter defiance, or complete ignorance of the facts brought to notice by Sir A. Cotton as the results of his own careful surveys and levels, so fully set forth in his original Reports, and confirmed by Sir H. Montgomery and all other authorities, as described before.

The Government of India complained frequently and loudly after the Mutiny of the neglect of these most important works, and called for the revised estimates for their completion; at length in 1870 the estimates for the Eastern and Western Deltas, amounting to above twenty-seven lacks of rupees, were prepared and partly sanctioned, but the estimate for the Central Delta, giving a complete history of the works from the commencement, was wantonly pigeon-holed by the Chief Engineer for Irrigation for about a dozen years, and during all this time, the most fertile part of the whole district deliberately deprived of the proper means of irrigation and navigation; so lax, careless, and negligent has been the management of these great works for the last ten years, that the progress of them with these completion estimates has fallen off 70 per cent.; the cost of establishment has increased from about 22 per cent. on outlay, to 117 per cent. on productive works; at the same time that the collections for land and water-rate do not average Rs. 4 per acre, when Rs. 6 per acre was the amount fixed by the Board of Revenue on the completion of the Revenue Survey and Settlement in 1866. In fact the average collections per acre now are only a few annas in excess of the demand in 1846, when the project was under consideration, and the district was in the deplorably destitute condition described by the Government of the day, from the Reports of the most competent and trustworthy authorities. It is as well to note here that not only are the collections so far below the fixed rate, but the extent of irrigation is falling off every year from want of any proper attention to the interests and welfare of the ryots, who are always ready and willing to take the water if protected from the rapacity of a host of petty Revenue and Public Works Officials; the pest and nuisance of all Indian administration.

I have already given a statement of the Revenue of the district from all sources for forty years, before these works were constructed, when the highest was under twenty-seven lacks of rupees, and the lowest about seventeen lacks of rupees, the average being under twenty-two lacks of rupees, and the country was frequently visited by famine: in Appendix I

is given the Revenue of this same district from 1846-47 to 1882-83 from all sources, with an account of Exports and Imports, and Treasure.

From this it appears that in the Famine year of 1877-78 the most disastrous season ever known in Madras, the total Revenue of the district was fifty-six lacks of rupees, and rose in the following year to sixty-two lacks of rupees, but has since fallen to fifty-nine lacks of rupees, owing, no doubt, to the perfunctory manner in which it is now attended to, as before described: the general trade of the district has increased from fourteen lacks of rupees in value in 1846-47 to one hundred and seventy-four and three-fourth lacks of rupees in 1882-83, and the population which it was found had decreased 25 per cent. in 1842 and was then only 560,000, is now fully 1,700,000, having trebled in about forty years. It will be seen then that the expectations of the Marquis of Tweedale's Government have been more than realized, not only has there been a large increase of Revenue, but the welfare and prosperity of the people of the district have been fully secured, when during such a season of distress as that of 1877-78, they could pay with ease two and a half times the Revenue they had been able to pay before these works were constructed, on an average, with the greatest difficulty, and the volume of their trade has been increased twelve and a half-fold.

At the time when the district had a population of only 560,000, the average rate of assessment per head of population was about Rs. 4, and the collections about Rs. 3 per head: in 1846-47 this population was perhaps 575,000, the total Revenue then was about twenty-two and a quarter lacks of rupees, or just under Rs. 4 per head of population, and the value of the trade was Rs. 2·4 per head: in the Famine year of 1877-78 the population was about 1,700,000, and the total Revenue about fifty-six lacks of rupees, or Rs. 3·3 per head of population, the value of the trade was Rs. 8 per head: the highest Revenue obtained was in 1878-79 being about sixty-two and a quarter lacks of rupees or Rs. 3·6 per head, but the trade was only Rs. 4 per head: in the last year of record, 1882-83, the total Revenue was about fifty-nine and two-third lacks of rupees, which gives about Rs. 3·5 per head as the average of the collections, when the trade had increased to Rs. 10¼ per head of population, which is double the average, per head, for all India, this being under Rs. 5 per head of population in value. As the district is not now made to pay one-third of the value of its trade for the Government, and in former years with one-third of the population, it had to pay a demand nearly double the value of its trade in those days, it cannot be said the Board of Revenue have done anything to secure the just demands of the State for all the outlay incurred for the benefit of this one district out of the public Revenues; in fact it does not realize half the demand it ought to collect according to its own survey and settlement rates, without taking into account the exemptions made in favour of the native proprietors, without any regard to public interests; yet in the face

of these facts General R. Strachey, R.E., says, he has satisfied himself, the Godavery Anicut Works do not pay 5 per cent. on the outlay, and Mr. Wilson, C.S., who was specially deputed to the duty, says, the returns may be 7½ per cent. on outlay: it can be easily judged on what data their Reports are based from the details I have given above; the total outlay on these works is about one hundred and seven lacks of rupees, and in the worst season of famine ever known in Southern India, the district which was protected by them, with its population trebled, paid with such ease an increase of thirty-four lacks of rupees in revenue, and was possessed of a twelve and a half-fold increase of trade, secured from all the contingencies of seasons. As it is pretended all this prosperity is chiefly due to the system of collecting land-revenue, and very indirectly if at all to the works, recommended in former years, I give a statement below shewing the land-revenue of all the districts of the Madras Presidency for the years 1876 and 1877, exhibiting the losses incurred in each during the famine year, as these are all under the same Revenue management and administration exactly as the Godavery District.

Revenues of the Madras Districts in 1876 *and* 1877, *(Land only)*.

	1876.	1877.	
Ganjam	Rs. 11,73,480	Rs. 11,99,080	+ Rs. 25,600
Vizagapatam... ...	„ 13,77,160	„ 13,55,500	− „ 21,660
Godavery	„ 42,67,300	„ 42,14,500	− „ 52,800
Kistnah	„ 42,24,840	„ 30,53,060	− „ 11,71,780
Nellore	„ 20,56,350	„ 8,63,470	− „ 11,92,880
Cuddapah	„ 17,95,850	„ 2,33,950	− „ 15,61,900
Bellary	„ 23,43,430	„ 2,97,670	− „ 20,45,760
Kurnool	„ 15,00,930	„ 98,320	− „ 14,02,610
Madras	„ 78,970	„ 72,350	− „ 6,620
Chingleput	„ 11,69,550	„ 3,53,200	− „ 8,16,350
North Arcot	„ 22,27,050	„ 7,15,740	− „ 15,11,310
South Arcot	„ 27,20,120	„ 20,12,340	− „ 7,07,780
Tanjore	„ 41,39,460	„ 38,44,100	− „ 2,95,360
Trichinopoly	„ 13,46,800	„ 13,73,330	− „ 26,530
Madura	„ 31,04,920	„ 7,68,030	− „ 23,36,890
Tinnevelly	„ 26,91,590	„ 22,70,510	− „ 4,21,080
Coimbatore	„ 25,86,810	„ 12,40,070	− „ 13,46,740
Neilgherry	„ 38,920	„ 53,530	+ „ 14,610
Salem	„ 21,05,610	„ 6,89,240	− „ 14,16,370
South Canara... ...	„ 12,54,570	„ 13,04,800	+ „ 50,230
Malabar	„ 18,22,720	„ 18,33,220	+ „ 10,500
Total Rs...	4,42,26,420	2,78,45,980	− 1,63,80,440

It is to be noted that in these districts after more than seventy-five years' management and control under the Board of Revenue, Madras, in one year, there was a loss of land-revenue *alone*, of upwards of one hundred and sixty-four lacks of rupees, so well had the interests and welfare of these people been attended to under the system of collecting

land-revenue! What the loss of life, ryots' property, and sufferings of these poor creatures were, will never be known in this world, we only know they perished by the million; and with these facts before him, Mr. W. Wilson dares to come forward, and tell the public the Godavery Works are not worth 7 per cent. a year for the outlay on them, what reliance then is to be placed on any returns of the Board of Revenue, and those employed under them to bolster up their system?

The following has appeared in the *Madras Mail* of the 21st October 1884, and fully confirms the account given of the condition of Hydraulic Works in Mysore; in five years in the adjacent district of Bellary, under most unfavourable circumstances, the area of cultivation under its tanks was more than doubled, whilst in Mysore during some twenty-five years these works were allowed to go to ruin under an officer said to be a most eminent Hydraulic Engineer:—

THE MYSORE BUDGET.

(*Madras Mail*, 21st October 1884.)

"The *Pioneer*.—The Dewan of Mysore may take credit to himself for the annual statement which he was able to make on the 1st instant at the Dusserah Durbar before what, with a due regard to modern tastes, is called 'the representative assembly of ryots and merchants.' The totals of the State balance-sheet for 1883 have already been published, showing a balance in hand of nearly five lacks of rupees, which is a considerable improvement upon the results of the previous year; but the statement contains much other important matter, especially that relating to land assessment and irrigation. In a province such as Mysore which is periodically threatened with drought, the question of irrigation is of even more importance than in other parts of India, and the measures now about to be taken for the general repair of all disused tanks if only likely to protect a small area, are at least practical as far as they go. The tanks of Mysore are said at one time to have been 37,682 in number, so that it would have been a matter of difficulty to have found a site for a new one, but this excellent system of irrigation for which the rivers of the country afford special facilities has suffered from many years of neglect, and now, as the Dewan tells us: 'We cannot conceal from ourselves that a large number of these tanks are in complete ruin.' This deterioration, it must be admitted, took place under British rule, owing to an attempt to substitute a village cess and official control for the *inams*, privileges, and forced labour of former days. The village organization for the repair of the tanks fell to pieces, and the tanks themselves were soon allowed to do likewise, when it was found that the new cess fell very far short of covering the annual cost of repair. A partial return will now be made to the old system. The irrigation cess will be removed, various concessions granted and with regard to all the minor tanks the system of village responsibility for repair will be intro-

duced. It is, however, to the extension of the railway system that Mysore must look for protection against famine, and to this the Mysore Government is fully alive. When the line from Tiptur to Harihar is completed the area which suffered most in 1876 will be comparatively safe."

J. F. F.

What actually happened in Madura gives a good exemplification of this Revenue management; the Government were warned early in 1876, by the Department Public Works, that the early spring rains of the season had totally failed, that the previous season had been a disastrous one, and if any further failure of the rains occurred, famine was most imminent: this Report was referred to the Collector, who immediately assured the Government there was no occasion whatever for any alarm, in fact this was quite groundless; and the officer who had given the warning was then ordered "not to write any more about famines, as he did not understand the subject." A total failure of both monsoons occurred in 1876, and in Madura in 1877, the loss of Revenue from land alone was nearly Rs. 23,37,000, upwards of 70 per cent. on the previous years' collections, and the people perished by the thousand, as the district is one of the most populous in Southern India: the truth of the old line,

"Where ignorance is *bliss*, 'tis folly to be wise,"

has perhaps never been better established.

All that the Duke of Buckingham's Government could do for these wretched districts and the miserable survivors, was to order a more rigid exaction of the land-revenue, as soon as any rain fell to alleviate their sufferings, and before a harvest could be got in and sold; publishing a Minute by their Professional Adviser on "The Famine Zone of the Madras Presidency," comprising most of the above districts, in none of which had he ever served, having passed twenty-two years of his service in one of the coolest and most pleasant stations of India, which he proposed to supply with water by means of a reservoir, and when he had constructed this at a cost of some £70,000, it was found to be on too low a level to be of any use, not even the numbers of the inhabitants to be supplied with water having been correctly ascertained; after this display of deplorable incompetency as an Hydraulic Engineer, this same officer is permitted by the Duke of Buckingham's Government to declare, officially, that in the Famine Zone of the Madras Presidency "Hydraulic Works of a paying, or of a promising character even, are out of the question." Contrast for a moment such proceedings as these with the conduct of the Marquis of Tweedale's Government under similar circumstances for one district only, the Christian benevolence, the manly devotion of mind and body, by every possible means to afford every assistance to people suffering from such a scourge, and to secure them in all future

from the recurrence of such horrors and the successful result of their labours as a guide for the future; yet all this is now to be thrown away, and we are again told Hydraulic Works do not pay, and there is nothing for it but to collect land-revenue, and for all officials to go to the Hills for seven months in the year.

There is not a district of the Madras Presidency which cannot be as well protected from famine as I have shewn the Godavery has been by properly designed Hydraulic Works; which will pay for their construction, yield a large Revenue to the Government as the Godavery Works now do without any increased demand on the population; providing these with the means of carrying on a flourishing and remunerating agriculture, if only the Board of Revenue and their myrmidons are prevented doing all the mischief they possibly can, as they have too successfully practised in Tanjore, the Godavery and Kistnah Districts, in which alone any such works have been attempted.

The Tongabudra River can supply, from its never-failing sources, the whole of Bellary, Kurnool, Cuddapah and Nellore, if only the reservoir so long proposed to be constructed on it were built. In the basin of the Pennar River, there are a number of sites for reservoirs to store water in, for the use of these districts during the hot weather. And a line of navigable canal can be easily established from the town of Bellary through the same districts to the East Coast and Madras. The valley of the Cauvery which always receives an abundant supply of water from both monsoons could, by means of reservoirs, protect Coimbatore, a part of Mysore, Madura, Trichinopoly, South Arcot and all Tanjore. Tinnevelly does not appear to require any great protection. In North Arcot are many valuable streams on which reservoirs can be constructed for its own use and for the use of the neighbouring districts.

Ganjam is about to have the waters of the Rooshkoolia River made available for its use, as the estimates are sanctioned; but for one-twelve-months the Professional Department have been unable to do anything, as the Revenue Officials have not made over the land, and this is the way projects for the use and protection of the people are treated in Madras. Vizagapatam is chiefly zemindary, and after the experience of the Godavery, no professional officer of any judgment would undertake any works there, but many sites exist for most valuable reservoirs. The Kistnah, including Guntoor, has been provided with a good anicut and a system of works, but these have been sadly neglected, or very leisurely attended to, yet the District of Guntoor, under the protection of these works, passed almost scatheless through 1877, when in the Famine of 1833-34 it suffered such horrors and losses.

Mysore is now under a Native Government, and it is to be hoped its Public Works will be better attended to than they had been in the last thirty years, when it was left wholly unprotected to meet the Famine of 1877, only silly Minutes "how best not to do it" having been prepared

for its use and benefit, but in that Province, any number of most useful reservoirs can be constructed.

It will thus be seen that almost all Southern India can be well protected from famine by properly designed Hydraulic Works, and surely the success of the Godavery Works affords us every encouragement to proceed with these at once. This district which once suffered so cruelly from famine having passed through the late crisis paying two and a half times as much Revenue as it had ever been able to afford before the works were built, and with so much ease that this is only about one shilling per head in excess of the collections in former years of dire distress: its population having been trebled in about forty years, and possessing a twelve and a half-fold increase of trade, so securely established on a general system of works of irrigation and navigation, as to be quite independent of the vicissitudes of seasons, at the same time that all the outlay by the State has been paid back into the Treasury at least twice over, and if the just demand of the State had been properly enforced and collected, the return to the Treasury would have been five-fold the cost of the works.

That this is no exaggeration is quite evident from the consideration that in 1846, when the collections of Revenue averaged Rs. 4 per head of population, the price of Rice, the staple product of this district, was *under* Re. 1 per bag at Coconada; *now* the price is about Rs. 5 per bag, but the Revenue collections average about Rs. 3·5 per head of population, and all the native proprietors have been let off the water-rate almost altogether, though this staple produce is raised in perfect security every year, independent of the seasons, and conveyed to markets and ports, at the cheapest possible rates by water carriage entirely by the aid of these works: under these circumstances it is very apparent no reliance whatever can be placed on the steps Messrs. Strachey and Wilson have taken, to assure themselves of the value and importance of the Godavery Anicut Project.

The following has appeared in the *Madras Mail* of the 2nd September 1884, and gives, on the highest authority in the Presidency, a faithful account of the condition of the population in the several districts of Madras, from whom the Duke of Buckingham's Government directed all arrears of land-revenue should be most rigidly exacted immediately after the late famine, and for whom nothing whatever has since been done to prevent the recurrence of those horrors. The italics are ours:—

THE BOARD OF REVENUE ON MALARIA.

The summing up of the Revenue Board of the opinions laid before them by Provincial authorities regarding a Village Sanitary Act, is deserving of some attention. In a few forcible sentences the whole question of malaria is disclosed:—

The Board beg respectfully to demur to the dictum of Government contained in paragraph 2 of the Government Order under reply. They

do not consider that it is "beyond question that the most active agents not only in nourishing epidemics, but in the generation of those endemic malarial fevers which thus carry off the bulk of the population are to be found in filthy backyards and house premises and consequently polluted water-supply. These causes, the Board believe (and they speak from long personal experience of many districts in the Presidency), are very far removed from being the most active agents in causing the mortality alluded to. Its primary cause is beyond the reach of any Sanitary Commission or Commissioner, *and is the general poverty of the people. Because they are so poor they are forced to live in such small huts or houses, to clothe and feed themselves so poorly, and to sleep in the open air. The least cold gives them fever, and they succumb to its attacks very readily.* The best proof of this is afforded by the vital statistics of the Presidency, which show that during the dry and hot months of the year the mortality is least, while during the wet and cold months it is highest. Why is this? At first sight it would appear as if the wet season must be the healthiest, because then the heavy rainfall flushes all the house backyards and drains, and because then all manure heaps are spread on the fields, while during the hot weather the manure heaps are lying in the backyards, which are then at their dirtiest. But facts prove theories to be wrong. The people enjoy better health when living alongside their manure heaps, and in their dirty backyards under a sweltering sun than when cold winds are blowing and heavy rains are falling, and their backyards and drains are all washed clean. Then it is that they most readily sicken and die of fever; and so it would be, the Board believe, if there were no manure heaps or dirty backyards to give rise to misleading theories.

J. F. F.

GODAVERY—APPENDIX I—DISTRICT.

Years.	Land Revenue.	Other Sources.	Imports.	Exports.	Treasure.		Totals.
					Imports.	Exports.	
	RS.	RS.	RS.	RS.	RS.	RS.	RS.
1846-47	18,25,827	4,06,687	3,90,094	7,89,520	82,900	1,39,028	36,34,056
1847-48	18,75,526	3,99,987	4,12,056	8,12,980	88,957	1,42,033	37,31,539
1848-49	19,31,299	3,89,521	3,25,440	8,05,925	91,085	92,670	36,35,940
1849-50	19,44,807	3,99,827	2,18,999	7,35,197	88,265	77,260	34,64,355
1850-51	19,91,485	3,73,865	1,89,344	9,98,929	1,98,901	78,650	38,31,174
1851-52	20,45,537	4,26,126	1,33,060	10,47,624	2,19,836	36,400	39,08,583
1852-53	20,67,116	4,55,958	1,00,647	13,23,223	1,58,093	7,800	41,12,837
1853-54	20,18,926	4,04,950	1,16,205	15,32,380	65,609	31,840	41,69,910
1854-55	20,48,320	4,53,461	2,36,042	22,787	1,06,524	...	28,67,134
1855-56	21,08,223	4,50,008	1,59,315	1,59,315	17,000	17,000	29,10,861
1856-57	22,03,236	4,32,949	3,42,460	14,10,124	1,76,359	67,800	46,32,928
1857-58	22,45,472	4,36,887	2,70,164	24,57,486	2,09,834	50,300	56,70,143
1858-59	24,45,087	4,58,292	2,64,588	23,10,731	2,83,110	65,900	58,27,708
1859-60	28,16,107	5,20,242	2,09,274	20,01,812	2,97,894	43,500	58,88,829
1860-61	33,71,331	6,85,343	2,85,684	31,53,161	8,37,269	37,000	83,69,788
1861-62	31,74,643	6,42,470	74,494	23,79,784	74,500	65,750	64,11,641
1862-63	34,04,837	6,93,396	5,64,020	29,02,962	4,77,650	93,050	81,35,915
1863-64	35,48,159	6,67,336	5,07,137	43,75,215	2,88,125	1,55,080	95,41,052
1864-65	34,89,258	7,75,525	6,79,868	51,97,445	7,39,379	6,21,364	1,15,02,839
1865-66	42,50,776	6,98,463	4,48,787	72,94,154	8,89,175	6,98,150	1,42,79,665
1866-67	38,00,403	8,28,807	3,87,185	41,75,399	1,12,401	6,74,600	99,78,795
1867-68	38,64,216	8,33,143	5,97,828	32,96,836	...	...	85,92,023

GODAVERY—APPENDIX I—DISTRICT—(*continued.*)

Years.	Land Revenue.	Other Sources.	Imports.	Exports.	Treasure.		Totals.
					Imports.	Exports.	
	RS.	RS.	RS.	RS.	RS.	RS.	RS.
1868-69	37,79,968	8,86,834	6,09,573	59,40,050	...	...	1,12,16,425
1869-70	40,72,685	9,71,644	8,12,598	76,09,584	11,63,338	10,61,349	1,56,90,998
1870-71	40,97,661	10,72,797	6,76,634	49,30,556	2,000	26,78,613	1,34,58,261
1871-72	40,51,723	9,67,949	5,34,558	77,71,440	53,875	6,14,300	1,39,93,845
1872-73	39,81,252	11,10,838	4,10,424	55,92,877	...	...	1,10,75,391
1873-74	41,54,047	10,18,982	5,57,887	52,82,026	50	...	1,10,12,992
1874-75	41,74,754	11,31,456	7,50,237	79,62,553	70,242	4,05,000	1,44,94,242
1875-76	42,67,304	12,16,959	18,40,397	83,71,648	3,40,288	10,000	1,60,46,596
1876-77	42,14,449	12,22,444	20,61,648	1,22,38,643	21,38,653	6,14,820	2,24,90,657
1877-78	43,02,013	13,03,944	26,02,327	69,64,404	21,19,593	17,58,000	1,90,50,281
1878-79	45,17,244	17,12,362	22,34,248	45,84,580	3,70,222	2,30,546	1,36,49,202
1879-80	45,15,382	16,32,863	21,14,241	89,26,314	2,10,350	2,720	1,74,01,870
1880-81	43,36,473	16,92,045	21,88,008	1,11,34,837	12,09,868	6,30,000	2,11,91,231
1881-82	43,65,729	17,61,761	21,46,934	1,24,09,754	6,31,410	50,000	2,13,65,588
1882-83	42,20,681	17,44,200	26,41,887	1,26,25,135	21,00,677	1,05,000	2,34,37,580

24th July 1884.

JNO. F. FISCHER,

General, R. E.

CHAPTER I.

GENERAL CONSIDERATIONS ON THE IMPORTANCE OF COMMUNICATIONS TO THE IMPROVEMENT OF INDIA, AND THE STRANGE NEGLECT OF THEM BY THE BRITISH GOVERNMENT.

The utter want of Appreciation of the Subject hitherto.

THE object of the present book is to try and lead those who are capable of such an undertaking, to investigate the subject of communications in India as a whole. I cannot find that this has ever been attempted. So far as I have been able to ascertain, whatever has been done in the case hitherto has been done as a patch. One man has thought it would be very nice to travel at the rate of forty miles an hour from such a place to such a place, and he begins to examine whether this can be accomplished; and if he thinks that a Railroad on that line would pay the interest of the Capital expended on it, or if it will pay part of it, and he can get the Government to make up the deficiency, the whole subject is exhausted. Whether it is the best way of accomplishing his object, whether *his* object is *the* object even on that particular line, whether this work will form part of a whole system of works adapted to India, whether it will hinder or help forward the welfare of India generally, so far as that will be affected by suitable communications, and many other points of a general nature, have not been at all considered. So far as the shareholders are concerned, it may be thought sufficient for them if there be a fair presumption that good interest will be returned for their money; but that cannot be the whole of the question to the Government and those who are interested in the welfare of India: nor is it in fact even the whole of the subject to the shareholders. They have not only to ascertain that such a work will pay, but that it is so nearly the best and most suitable means, considering the peculiar circumstances of the case, that it will not be in danger from a better planned rival.

Of the superficial way in which the question has been considered hitherto, even taking it in its narrowest view, and thinking only of the point whether a Railroad on a certain line will pay, we have a curious instance in the Calcutta Railway. The traffic is there, and it is proposed to construct the Railway, and calculations are given to show that

such a traffic on such a Railway will pay such interest, but whether the Railway when it is ready can carry the traffic, has not been considered. The traffic is one and a half million tons a year or 5,000 tons a day, on an average of the whole line and of the year; which of course implies that at the busy time of the year and near Calcutta, there will be at least 10,000 tons a day besides 1,600 passengers. Can a double Railway carry 10,000 tons a day besides 1,600 passengers? The busiest Passenger Railroad in England only carries 700 tons a day on an average according to Lardner, or one-seventh of the quantity upon which these calculations are based. We have no data as to what amount of goods a Railway worked at high speed for passengers can carry, but we know certainly that it could not carry 10,000 tons of goods a day; so that when the road is finished, either only a small part of the goods can be carried, or additional Rails must be laid, or it must be worked at one speed for all, both goods and passengers, and that a very low one; any of which expedients, however, entirely overthrow the calculations of profit.

If a great national question is thus taken up, without a careful investigation of the whole subject, there can be no hope of its being wisely managed. We must form some distinct idea of the actual importance of the subject, the extent of the loss in the present state of things, the precise nature of the evil, the amount of labour and expenditure required to counteract it, the difficulties that we may expect to encounter, the value of time in applying a remedy, &c., before we can set about the matter in an effective way; in short we must count the cost, if we hope to finish the work. If we have not some tolerable measure of the amount of evil before us, we shall either be continually liable to give up the attempt to obtain a remedy upon every difficulty that we encounter; or on the other hand, we shall be wasting our money and our energies, on a remedy for an evil which is not worth so great efforts and sacrifices.

There cannot be any greater proof of the evil consequences of doing things without any general investigation, than the history of communications in India up to this time; the desultory way in which the matter has been attended to, and the consequent failures and waste of money that we have seen. While the loss from want of communications was so great, that there were a thousand ways and a thousand plans in which money might have been expended with the greatest advantage, perhaps crores of rupees (millions sterling) have been thrown away from a total want of judgment in managing the expenditure.

The history of communications in the Madras Presidency, is one of the most curious of all the odd things that have occurred in the management of India. A sketch of this may be of great use as a warning to us in our future proceedings. The first roads made probably were those in Tanjore. When it was proposed to open one or two lines in that impassable sheet of irrigation, it was immediately objected, "Well, this is a fine

proposition; to make fine roads where there is not a horse or a cart to be found." There was not a mile in the whole Delta along which a horse or a cart could have moved. After some struggling, however, a first attempt was made, and it was discovered, that when there were cart-roads, carts were used. But what was done in Tanjore, was done without the least reference to any other part of the country. The questions were never asked; "But if roads are to be made, where are they most "wanted? where will Capital so expended produce the greatest results? "which ought to be made first, &c., &c.?" Tanjore, possessing the most active Government Officers, got roads; and the rest of the country generally remained without them, as it is to this day. The next roads were probably those made by the Pioneers. The arrangements for these works placed the whole management in the hands of the Officer commanding the Battalion, who had probably obtained the post by private favour, and certainly without any special qualification. He had never considered a made road; for he had left England before he was old enough to entertain a thought about the roads he travelled over there. He had not an idea on the whole subject, nor a book to refer to. Of the principles on which the lines should be selected, as well as those on which the roads should be constructed, he was utterly ignorant. He soon found that one thousand men were lost upon a hundred miles of road, and obtained permission to employ a few thousand coolies; and thus besides the cost of the Pioneers, a few lacks of rupees were spent by a man who had not the slightest knowledge of, or even natural turn for, the work he was employed upon.

The road from Masulipatam on the Coast (300 miles north of Madras) to Hyderabad, a distance of 220 miles, was one of those executed in this manner. When about eight lacks of rupees (£80,000) had been spent upon it, besides the pay of the Pioneers, the Court of Directors put a stop to it; and as no metal of any kind was put on most of it, the road has never yet been practicable in the wet season, and even in the dry season the communication is very little better, if at all, than it was.

There is not the slightest exaggeration in this; it is a literal statement of the *usual* course of proceedings, in times past. No check of the remotest kind was exercised over these works; not a single professional Officer had anything whatever to do with them. The Quarter Master General under whom they were carried on, was as perfectly ignorant of the matter, and probably at least as inexperienced, as the Executive Officers. Of the state of things a very distinct idea may be formed by the following anecdote: One of the Officers commanding the Pioneers employed as above described, drew up a Memorandum on the best construction for a road on cotton soil, (black alluvial mud without sand or gravel mixed with it;) and highly pleased with the knowledge he had attained, he sent it to the Quarter Master General. Struck by the

remarkable talent displayed in the paper, the Quarter Master General sent a copy of it to all Officers employed in that department; and that the utmost possible use might be made of it, he also sent a copy to the Chief Engineer, that he might circulate it through that corps. The plan was this; first a complete layer of large stones, about a foot or a foot and a half thick was to be laid over the whole surface to be occupied by the road, and over them was then to be laid three feet thick of the black cotton soil, to raise the road to a sufficient height and prevent its being flooded. By this admirable arrangement almost any amount of money might be spent, as in such a situation the stones would have to be brought several miles, and at the same time the surface of the road being formed of the natural soil, but thoroughly loosened by being dug and thrown up, would be ten times worse than the original surface of the country. Such was the state of knowledge of road-making, among those who conducted the undertakings, and who were entrusted without check or supervision, with the expenditure of many lacks of rupees. Only about 120 miles of the whole distance to Hyderabad was meddled with: the money spent for a very imperfect work, was therefore nearly £700 (Rs. 7,000) a mile, or twice as much as would make an excellent metalled road, and quite as much as would have made a good horse Railroad, (for there is not a single difficulty on the line,) which would have reduced the cost of transit to one-twelfth of what it was and still is. The road from Madras to Poonamallee, eleven miles, was a similar case; and as in this case the Pioneer Officer was able to communicate constantly with the authorities in person, he was not so restricted about expenditure as in the other case, and accordingly £45,000 (Rs. 4,50,000) was spent on this line, or £5,000 (Rs. 50,000) a mile. The Court of Directors now saw that it was necessary to apply a remedy; and that was, to order that no more roads should be made.

However, after some years, another line of road was nevertheless commenced by the Government; and this time the really most important direction in the Presidency was selected, *viz.*, that leading from Madras directly into the interior 120 miles. But exactly the same mistakes were made about its execution. It was put under a non-professional Officer, not a single Engineer was employed upon it, there was no open discussion about it, the line was badly selected, enormous labour was wasted on it, and it was not in any sense completed. The whole evil lies in the snug way in which things are done in India. In England no work is undertaken without endless discussions. The wits and experience of hundreds of professional Engineers are brought to bear upon it, and of tens of thousands of others, men of common sense and local knowledge, and yet after all great mistakes are often made: what must be the case then, when not a single man of professional knowledge and experience is employed upon a public work, and not the least attempt is

made to get the opinions and help of the public generally? This road cost £1,000 (Rs. 10,000) a mile; much more than a horse Railroad need have cost; and the Court repeated their former orders with much more determination, when they heard of this work. It was, however, a work of immense value; imperfect as it was, there has been an enormous traffic on it, and it has saved in the cost of traffic, much more than 100 per cent. on its cost; the rate of transit having been reduced to about one-third of what it was previously.

These desultory proceedings, however, of course, upon the whole, only retarded the general improvement of the communications. At length something like a systematic attempt was made to introduce roads into Madras. A Road Department was formed with the approval of the Court; but the same error was committed of having no thorough investigation or open discussion. A professional Officer was indeed appointed; but as he had charge of all the main roads of the Presidency, and only two Assistants, he was completely lost in his duties; and every thing was still done in the same way without open discussion. Some work, however, was really done. The great road from Madras abovementioned was much improved, and some other lines commenced. But now a new difficulty arose. The Local Government were reluctant to sanction the expenditure which the Court had authorized; and the Superintendent of Roads was so cramped in every way, that though he wore himself out in his work, but little was effected.

This outline is of great importance to show what the real state of things has been, and why no real progress has been made here and generally in India in opening the country.

The great line from Calcutta to the North-West is almost the only important work that has yet been executed, and after all it is but a common road. Some real progress has, however, also been made of late years in the North-West in improving the roads, and one step of real progress has been commenced upon, in the cutting of the Ganges Canal. When this work is opened, there will be 400 miles of cheap and expeditious communication on one of the most important lines in India. The cost of transit in this will probably not exceed one-fourth farthing (half pie) per ton per mile. This is certainly the first, and at present the only step towards opening India. Till such *cheap* communications are opened, nothing at all is done.

Had the Court of Directors taken up this subject systematically, and had they had before them in figures the tremendous incubus that the cost of transit is upon the country, it is impossible that matters could have gone on in this way. A real apprehension of the importance of communications would have certainly led to such an attention to the subject, that the Department of Public Works would have been considered one of the very first in the State.

Certainly, without any exaggeration, the most astonishing thing in the history of our rule in India, is that such innumerable volumes should have been written by the ablest men in the Service on *the mode of collecting the land-revenue*, while the question of a thousand times more importance, how to enable people to pay it, was literally never touched upon. And yet even the question of the *amount* of taxation was utterly insignificant in comparison with that. While the Court of Directors, the Councils, the Boards, and the Local Authorities, have been labouring for a hundred years to discover how to get twenty lacks (£20,000) out of a district which is not able to pay it, not the least thought has been bestowed on the hundreds of lacks (millions) it was losing from the enormous cost of transit, which swallowed up all the value of the ryots' produce, if they raised it. The roads are not the only Public Works that are wanted, irrigation also is in this country of the very first importance; but no irrigation will bring the country to a state of great prosperity without the means of conveying produce to a market, and cheap communications will have an immense effect even in enabling one part of the country to help another in the matter of food if local rains fail.

The question is, not whether a Railroad will pay on a certain line of 100 or 1,000 miles, but rather, "What is the importance of providing all India with communications, and the best mode of doing so, considering the various circumstances which affect the case?" Till the subject is taken up on this ground, nothing effectual will be done; and any particular lines improved will be just as likely to hinder, as to help the great work. It is certain that up to the commencement of the Railroads, the individual works undertaken in this Presidency were the main hindrances to a general system of communications. The Court instead of learning from the mistakes that were made, how to set about this important work in future, only concluded to do nothing. For the last four years, since the agitation about Railroads commenced, the consideration of this question has completely blinded Government and others; effectually preventing any real attempt to open out India. While millions of words, and lacks of rupees, have been expended on a few miles of road, in two corners of the country,* the whole of India has been lying untouched in the same miserable and disgraceful state as before; whereas, if this ill-considered expenditure had not been going on, perhaps the Government or the English Public might have employed their time in commencing upon a real and general project, for giving all India *cheap* communications.

Some symptoms of a change of views in the matter have now indeed begun to appear; but nothing whatever that gives the least indication of a really right understanding of the state of the case. The sanction

* Since this was written, a third line has been commenced in the Madras Presidency.

of four lacks (£40,000) to be spent where 400 lacks (four millions sterling) would be insufficient, the attempt to accomplish these vast works by means of the present Revenue, the appointment of one Officer to do more than twenty could do, and the fact of the Local Government not laying out on communications even the comparatively small sum ordered by the Court of Directors for that purpose,—all these circumstances distinctly show that the whole thing is misapprehended by the Court of Directors, and that they still cling to the old idea, that if only the subject of *collecting the Revenue* be attended to, every thing else will follow as a matter of course; whereas, the converse is very nearly true. If a Collector were only allowed and required to spend liberally on Public Works, the Revenue would undoubtedly follow in general, though certainly some intelligence would be required in managing the collection. A Collector would then require no sanction for money from the treasury as his district would provide the interest for whatever money he required, and abundance of increase of Revenue besides. The saving in the cost of transit on the Western road from Madras is fully cent. per cent. on the Capital expended, and the average return on most of the new Irrigation Works in the Madras Presidency for the last fourteen years, is 70 per cent. taking the whole of the years since their execution; and the *present* annual profit is at least cent. per cent. and that without counting the improvement of private property.

All the imaginary importance of Revenue systems has been imbibed from the Natives; the proposition was, "How is a certain amount of Revenue to be collected when the people have not the means of paying it?" No wonder a satisfactory result has not yet been arrived at. But if only the communications, Irrigation Works, and Ports were properly attended to, then the questions about Revenue systems would almost solve themselves; at least they would certainly be as little thought of as they are in England, where we do not hear of nine-tenths of the time of Parliament being taken up in investigating a mere question such as whether the land-tax shall be collected Ryotwar or Mowzawar. If the people were abundantly able to pay the taxes, the mode of arranging for the payment of the land-tax, would become soon a very secondary question. For instance, a Tassildar of a Talook which was in good order, said to me "All the Revenue comes into my treasury of itself by the day it is due, without my sending out a Peon to call for it." The system of imbibing erroneous ideas from the Natives instead of teaching them, pervades every branch of the Indian Service, and is at the bottom of all our blunders. The fact is, up to this day, the *country is governed by Natives.* Wherever you go, it is the Native ideas that are in operation. Nominally, Europeans are in authority; but they have insensibly imbibed the ideas of the Natives. Every European in the country has learnt in England the essential importance of communications and other

Public Works; but yet he acts exactly as if he knew nothing about it. If intelligent Natives went to England, they would be astonished beyond measure when seeing the inconceivable effect of cheap transit, that the English in this country should have been content to throw away all their own ideas on the subject, and adopt the ignorant narrow ideas of their subjects, and that instead of bringing their western knowledge, energy, activity, and common sense to bear, they should have adopted the views of a people without books or science. When the English begin to think for themselves, and bring their own Anglo-Saxon notions fairly to bear upon India, there will then be a wonderful change. A Native is by nature a very intelligent being, but he is utterly without our advantages. Imagine what a nation of Anglo-Saxons would be, who had not one single book worth reading in their language; and who had learnt nothing from books but drivellings such as are found in the Hindoo religious writings, which they themselves could see to be utter nonsense. And yet, such are the people we are content to learn from, instead of teaching them.

Where did the notion come from, that the grand point upon which the whole body of men entrusted with the government of the country were to employ their wits day and night, was "*how to collect a Revenue which the people could not pay under the present system*," instead of the question being "*how to enable them to pay it?*" The former is purely a Native idea, and that of the lowest kind. The old Public Works of Irrigation now existing, show plainly that at some previous time and in some places, Natives have had some idea that there were things of more importance than *collecting Revenue;* but so low have the Europeans sunk, that they have not even been roused by the sight of these valuable works, so far as to make it a point to keep them in repair. The very name of the local controllers of the Revenue shows unmistakeably how low an idea was formed of the duties of Government; they were called simply *Collectors*, clearly implying that *Collection* was the leading idea, and the supposition that all other things could take care of themselves. With a right view of the case, they would have been called *Directors of Public Works*, or some such title, and the *collection of the Revenue* would have been understood to be quite a secondary matter, and a thing that would follow of course, *when the people were enabled easily to pay it.* What wonderful infatuation is shown to this day in this matter! In the District of Tanjore which is taken care of, irrigated, protected from floods, drained, and provided with common roads, (though not with better communications,) the Revenue steadily rises, till from thirty (£300,000) it becomes fifty lacks (£500,000) a year; the population increases from seven or eight lacks to fifteen lacks (one and a half millions), and the land reaches a saleable value of at least four millions sterling, equal, considering the difference in the value of

money in India, to twenty-four millions in England. In the District of Guntoor on the other hand, all such works are utterly neglected, and in one year a famine occurs which sweeps away 250,000 people out of 500,000, and causes a loss of Revenue in the next ten or twelve years of eighty lacks (£800,000); while not an acre of land is saleable. The sole cause of this difference between these two districts, is the different degree of attention given to Public Works. I challenge the most brilliant Collector, (let him belong to any class of Revenue men you please, Ryotwar, Village Settlement, Zemindaree or any thing else), to show how he could have saved the unhappy District of Guntoor from these inconceivable horrors, and the treasury from this enormous loss; and on the other hand send the most stupid or indifferent Civilian that ever fattened upon India, to Tanjore, and see if he could have prevented its progress, if only the Public Works had been attended to. A difference he might have made certainly, but he would have found it hard to reduce the population to 300,000, and the Revenue to fifteen lacks (£150,000), or to have kept the land unsaleable.

And what would have been the progress of Tanjore, if, instead of the miserable petty expenditure that has been allowed it, (about Rs. 80,000 a year or one-fiftieth of the Revenue) a really liberal expenditure, equal only to one-tenth of the Revenue, had been reserved for this purpose. Probably the district is at this moment paying at least thirty lacks (£300,000) a year for the actual cost of transit, and losing much more in the value of things that cannot be moved from where they are produced to where they would be saleable; so that at the very lowest estimate, it is expending a sum equal to the whole Revenue, or fifty lacks (£500,000) a year for want of proper communications. And ought not Englishmen to know, that communications are an essential, if not the fundamental element, of national prosperity and wealth? Is this a thing that is now to be brought forward as a discovery? Could any man born and bred in England suppose that the subject of communications was a matter of utter insignificance, not worth a thought in comparison with that of *collecting the Revenue?* How could the whole body of our Rulers and *Collectors* have found room in their heads for such a notion, if they had not first surrendered all their English wits? Now suppose such a system of communications to have been introduced into Tanjore, as would have taken away nine-tenths of the cost of transit, and enabled the people to convey at a trifling expense every article worth a rupee (two shillings) a ton more in one part of the district than in another, so as to give an additional income equal to the whole present Revenue; what would have been the state of the district by this time, and how small a degree of skill and effort would have been required in a *Collector* to *collect* the present amount of Revenue, when it formed so small a portion of the annual income! One would

think it would be intelligible to every one, that the shortest way to remove the difficulties in *collecting the Revenue* of fifty lacks (£500,000), would be, to increase the income of the district by 150 (one and a half millions) or 200 lacks (two millions). On the other hand, suppose we were to destroy the Roads, Canals, Railroads, Harbours, Steam Engines, &c., in England, and then try to obtain a Revenue of fifty millions by means of a splendid Revenue system and crack *Collectors*, could all the wisdom of Parliament extort fifty or even five millions a year out of the country? and yet this is the only expedient that has been tried to facilitate the *collection* of the Revenue in India.

And this too after the indisputable proofs of the effects of attention to Public Works on the spot.* A statement (already alluded to) has lately been printed of the returns from forty Works of Irrigation, including all of any consequence executed in fourteen years in the Madras Presidency, and the result is, a net average annual return of 70 per cent. on all the works (including the few failures); and the average being taken from the year of the execution of the works, the returns at the present time must be at least 100 per cent., on the outlay. But this is exclusive of the increase in the indirect taxes, for of course the improved condition of the people and land causes an increase of Revenue from all articles paying duty; so that the whole actual returns in *Revenue* to Government from all sources at this moment, must be much more than 100 per cent.; and to this is to be added the increase of private property, which much exceeds that of the Revenue, so that at the very least we are certain that these works now return on an average 200 per cent. on their cost. The increase in private property is shown by the increase of the saleable value of land in Tanjore for instance, since the great works were executed in 1836, the 700,000 acres of irrigated land are now sold, on an average, at least twenty rupees (£2) an acre more than before; showing an increase of Capital of one and a half millions sterling.

* See First Report of the Madras Public Works Commissioners printed by order of the House of Commons.—Appendix (Z), page 371.

CHAPTER II.

THE VIEWS OF THE HOME INDIAN GOVERNMENT ON THE SUBJECT OF PUBLIC WORKS, AS EXHIBITED IN THE FINANCIAL DESPATCHES FROM THE COURT OF DIRECTORS.

Government Views on Finance and Public Works.

WHAT has been the effect of this astonishing gain from Public Works of Irrigation? Has this at last roused the Court of Directors to a sense of the grievous mistake that has been made, in doing so little in this way, and brought them at last to see the necessity in future of making Public Works the very first object of their attention, and led them to look out in future for crack *producers* of Revenue, rather than for crack *Collectors?* Have the Despatches of late run thus: "We cannot too "often or too earnestly impress upon you the absolute necessity of our "now setting ourselves in earnest, to repair with the least possible loss "of time the grievous error we have hitherto committed in our manage-"ment of India, in leaving its millions without those Public Works, in "the absence of which not only no increase of Revenue can possibly be "expected, but we cannot even preserve the lives of this vast popula-"tion. Neither can the loss of population and Revenue in Guntoor, nor "the Revenue returns of the few improvements that have been made, "leave any room for doubt now on this head. The imaginary difficulty "about the money for these works is now also seen to have no exist-"ence, for where works return 100 per cent. and Capital can be obtained "to any amount at 5 per cent., to say nothing of the thirteen and a half "millions sterling that we have at this moment in the Treasury, no one "can doubt about what should be done, &c." Whether common sense should not dictate such a Despatch as the foregoing, let the reader judge.

The following, however, are the words of the actual Finance Despatch "of 25th October 1848:—" The Land Revenue, the great source of "Permanent Income to Government, appears from the statement in the "margin to be on the whole in a satisfactory state." The statement in question shows an increase from about twelve and a quarter crores in 1839, to fourteen crores (fourteen millions) in 1848; but it omits to show how much of this was owing to increase of Territory; without which it shows

nothing at all. And in a further para., "The Madras Land Revenue "exhibits a considerable improvement since 1844-45. In the ten years "from 1829-30 to 1838-39, the depression in this most important branch "of Revenue was such as to occasion us great anxiety, the average "receipts during that period having been upwards of twenty-four lacks "(£240,000) per annum *less* than the average of the fifteen years "preceding 1829-30. Since 1838-39 the aspect has materially brightened. "In 1845 the receipts more than equalled the average amount realized "from twenty-five to thirty years ago, or before the deterioration already "alluded to commenced; and in 1846 there was further improvement of "eight lacks (£80,000), while the actual receipts of 1847, and the estimate "for 1848, were still more favourable. We, therefore, hope, that we may "safely pronounce the condition of the great bulk of the people employed "under the Presidency of Madras in agriculture, to have been much "improved of late, and our anxiety for the permanent prosperity of the "Land Revenue is consequently relieved."

But in this Extract not one word is said to show, whether this increase is owing to increased severity of taxation, or to increased ability to pay. We may make a tenant pay us £10 a year instead of £8, and say, "see how much richer he is!" Neither does the statement show, whether this increase be really the result of the Capital expended by Government in improvements, or whether any increase has also been derived from land for which Government have done nothing.

Who could suppose from this, that in one case at least in this interval, (from 1839 to 1848) the Local Government had brought expressly to the notice of the Court, that on an expenditure for an extensive improvement in a Public Work, an enormous return had been received! It appears from this Despatch, that such unanswerable proofs of what is wanted to put the finances to rights, do not produce one remark from the Court, when the subject of finance is expressly under investigation! How often do their servants erroneously imagine, that when they have proved by actual results the wisdom and necessity of a large system of improvement of the country, the grand point is gained; and that now at length a beginning will be made towards wiping off this abominable disgrace of our rule, that our only thought is, how to grind out of the poor ignorant people a little more Revenue, without an attempt even to enable them to pay it or to show them the incalculable advantages we have obtained in England by facilitating production and transit.

In the same Despatch, in examining the charges, the whole Civil Expenditure is lumped together; and not one single word is said, to distinguish what has been expended on permanent improvements, however great the returns, from the ordinary current expenditure. What would be thought of a merchant who should add up together, the salaries of his clerks, his office expenses, and the price of a new ship which

yielded him 100 per cent. per annum, and then call the total his annual expenditure? The practical result is, that the Court again and again simply urge *economy;* by which they mean reducing expenditure, whether productive or non-productive; whether the money be spent on a salary of £5,000 a year, on the repair of works upon which the very lives of the population depend, or on the construction of new works which would yield 100 or 200 per cent.

Though the Court have had so many proofs of the immense losses resulting from neglect of Public Works, and the enormous profit derived from the execution of them, it is evident that the object mentioned in the 66th para. of the Despatch, *viz.,* "*the equalisation of your Revenue and expenditure,*" has never yet been taken a right view of; the Court considering that it is to be attained by *reduction of expenditure,* instead of by increasing the *sources of income* to the people and thus *enabling the country to pay a better Revenue.* There can be no mistake on this point; if the latter idea had been in existence, indications of it must have appeared in this deliberate review of the finances of India by the Court of Directors. Who could believe that although one solitary district, Tanjore, exhibits the example of a system of moderate but actual improvement steadily pursued for fifty years with unvarying success, raising the Revenue from thirty to fifty lacks (£500,000) a year, while the saleable value of the land has equally advanced, till it is now (allowing for the difference in the value of money) equal to the value of land in England;—all this being accomplished not by a sudden extensive outlay of Capital producing even temporary difficulty to Government, but by an average annual expenditure of only about 40,000 rupees (£4,000) a year, besides current expenses for the repair of existing works —who would believe that the same system had not been applied to all the other districts of the country? The total sum expended in Tanjore is about twenty lacks (£200,000) and the increase of Revenue per annum is the same; the increase of private property in the value of land, is also about three or three and a half crores, (three to three and a half millions) indicating an addition of private income of eighteen or twenty lacks (£200,000) a year. The money was expended in embanking rivers, cutting channels for the distribution of water and for drainage, constructing weirs, sluices, aqueducts and other masonry works connected with irrigation and drainage; building many hundred bridges, and making 1,000 miles of common road for facilitating transit. This one district standing alone amidst all the districts of India, shows the cause why there is yet no "*equalisation of income and expenditure;*" and yet it fails to call forth a single remark from the Court of Directors. All the districts around have remained almost stationary, although some have, in a minor degree, had similar advantages granted to them. And the expenditure in Tanjore has been so inadequate to its requirements,

that the whole of its immense traffic is still carried by common roads: whereas, had a system of canals been added to the other works, the district would probably have benefited to the extent of another twenty lacks (£200,000) a year.

And if this improvement takes place in a single isolated district, what would it be, if improvement were so far general, that the people of each district could send to distant markets the produce best cultivated by themselves, obtaining in return from distant places such things as their district could only produce at increased cost? It must be allowed that Tanjore has benefited very greatly by one improvement beyond its own limits, *viz.*, the opening of the Paumbam Channel, between Ceylon and the Peninsula, which enables it to send its produce to Colombo one-third cheaper than before; thus producing a saving in freight on its 70,000 tons of exported rice, of more than four lacks (£40,000) a year. This shows how necessary it is to carry on these improvements generally, and how every district is interested in those executed in others. The sole reason why England has been paying to America instead of to India, millions a year for cotton, wheat, and rice, thus giving the former a monopoly, is, that Public Works have been energetically carried on in America, whereas they have NOT in India. And so long as the population of India are liable to scarcity and famine, and are obliged to carry their produce over hundreds of miles at a cost of 3*d.* or 4*d.* a ton per mile, (equal, from the greater value of money, to 1*s.* 6*d.* or 2*s.* in England,) and so long as the ports remain without shelter for shipping or depth of water for boats to land cargo, so long will the question of "*equalisation of income and expenditure*" remain unsolved, even though all the wisdom of England were consumed in devising *modes of collecting Revenue*, and *reducing expenditure*. Whereas, by the general application throughout India of the Tanjore system, the country will be enabled to pay two-thirds more Revenue than it now does, with an equal increase of private property besides; and the question will then be, *how to apply a surplus*, instead of, *how to make up a deficit*.

How strange it seems that it should be necessary to argue over all this, again and again! At present two persons out of every four are employed in growing food, and a third in carrying goods; and one would suppose it would be obvious to all, that if by Irrigation or any other means, one person instead of two could grow food for the whole four, and if by means of cheap transit one person could carry for forty instead of for four, thus leaving two and nine-tenths instead of only one out of every four persons, at liberty to labour either in providing luxuries for the four, or in producing things for sale to foreign states—then the worth of the country and its ability to pay an increased Revenue, would be enormously increased. Nobody can deny that by means of Irrigation, &c., one person can grow as much food as two do now, or that by means of improved transit the same labourer would convey many times as much

goods as he can with the present means; nor can it be denied that these advantages can be obtained at an outlay which would provide many times its interest: for all these points have already been proved again and again by actual results. And yet, all our Financiers are writing Despatches which imply, that there is but one way of "*equalising your income and expenditure,*" and that nearly an impossible one, viz., *reducing the expenditure.*

The Financial Despatch of the 18th June 1852 is similar to the one already noticed, excepting in one remarkable point, *viz.*, that it does mention as separate items, the expenditure on canals in the North West and on repairs of tanks in Madras; and although not a single remark is made on the results of this expenditure, yet the very notice of these works seems as if the first ray of light had dawned. Many are sure to think it really indicates the approach of daylight and one can hardly help flattering himself that it does; though after so many bitter disappointments, it is with fear and trembling that one admits the approach of such a hope. There is still, however, no distinction made between necessary current expenditure on repairs, and additional Capital sunk in new works; and consequently not one word about the increase of actual annual Revenue, as the return for such outlay. This is still, therefore, like a merchant adding together in his accounts, the current expenses of his establishment, and the cost of a new ship, or of 100 tons of goods. What merchant could tell whether he was likely to appear in the Gazette or not, if he did not keep his books in a better manner?

The only remark made by the Court on this outlay is as follows in para. 113 of the Despatch:—"We have not overlooked the compensating circumstances, that within the period under review, considerable outlays have been made in the prosecution of Public Works, such as must eventually contribute largely to the improvement of Her Majesty's Indian Territories." "But as the larger portion of the cost of these Public Works is applicable to such as are in progress only, and which will call for similar outlays in future years, we cannot but regard with much anxiety the existing deficiency; and we feel the importance of impressing in the strongest manner upon your consideration, the necessity of using your most strenuous endeavours to effect by every practicable economy and retrenchment consistent with the due administration of the public service, *such reductions of charge and debt* as may conduce to the restoration of a favourable balance between the receipts and expenditure of the Indian Finances." This in such a connection, is understood to mean, that Public Works must be stopped. On a late occasion when an estimate was submitted to the Madras Government for an outlay of 5,000 rupees (£500) to run some of the Steamers employed at the Godavery Works up the rivers, in order to ascertain more exactly what is required for making that magnificent river fully available, the

Local Government declined to sanction the expenditure upon their own responsibility, and under the impression that the object in view would cost at least Rs. 10,000 (£1,000), referred the matter to the Supreme Government, who rejected the application for this insignificant outlay, (upon which hang possible and indeed almost certain incalculable benefits to England and India) adding a few lines to the effect, that it was inexpedient in the then state of finances, to sanction money for an object of doubtful utility. With reference to these sentiments the following passage from the Court's Despatch above quoted, affords a noticeable comment:—"We have likewise found it necessary on several occasions "to remark that a considerable part of the money recently borrowed, "remains in your Treasuries, and has augmented your cash balances "which have been gradually increasing for some time past, and are of "higher amount by some crores of rupees, (millions sterling) than we "consider the exigencies of the public service require. While adverting "to this point, we may remark, that the latest estimate of their amount "on the 30th April 1852, exhibits the large and we believe the unprece- "dented sum of thirteen and a half crores as expected to be lying in the "Indian Treasuries at that date, &c. We invite *your most earnest atten- "tion to these circumstances*, and to the urgent expediency of applying "the excess of your cash balances to the liquidation of a portion of your "debt, or to an extensive reduction of the rate of interest now payable "upon it." But if the amount of interest were reduced without the payment of a portion of the debt, it is clear that the cash must still remain in the Treasuries, and the question of the disposal of this enormous superfluity will still be where it was. It is very curious that under urgent circumstances, so small a sum as 10,000 rupees (£1,000) could not be granted out of the sixty millions of rupees (six millions sterling) lying idle in the Treasuries, over and above the seventy-five millions of rupees (seven and a half millions sterling) required to veer and haul upon, with the present system of financial arrangements. It would be interesting to ascertain what portion of this latter sum would actually be necessary for the current expenditure, if only a better system of financial administration were followed.

Thus it is with this unfortunate country. It is labouring at once under two opposite evils; Treasuries overflowing with millions of rupees, and as many more ready as it chooses to accept at 4 per cent. interest, and at the same time, a want of Rs. 10,000 (£1,000) for the important object of examining an opening, by which it is well known, some of the greatest requirements both of England and India could be obtained.

It thus appears after all, that not only is it in the power of Government to obtain money for the purpose of throwing open India and relieving it from an annual expense of several millions sterling, now actually incurred in the conveyance of goods across the unimproved face of the

country, but that even supposing no better system of management could be arranged than one requiring the enormous sum of seven and a half millions sterling to be always in hand to meet current expenses, there are still six millions sterling now actually lying totally useless in the treasuries: quite sufficient to give 20,000 miles of lines of transit, at a cost not exceeding one-tenth of the present rate.

The examination of these financial letters is of the greatest importance, as showing exactly where the evil lies, *viz.*, that there is an utter misapprehension of this fundamental point. No notice is taken by the Court of the only thing which can by any possibility put the finances of India to rights. How wonderful an oversight this is, when probably there is not one of the authorities who, if asked, "Do you think England "could pay a Revenue of fifty millions, if she had no Public Works or "Machinery, no Roads, Canals, Railways, Ports, Steam and Water "Power, and nothing that enables the human power of the community "to accomplish a hundred times as much as it could without those "aids?" but would answer, "She certainly could not pay a tenth of it, "without those things;" and yet, when the Court of Directors all consult together what can be done to enable India to meet her expenses, they are totally at a loss to devise the only true remedy for existing deficiencies. If this be not one of the most extraordinary things connected with our management of India, it is at least wholly inexplicable to the Public. It cannot be that the Court believe a due attention to Public Works would set the finances to rights but think that attention unattainable, otherwise they would certainly have at least mentioned the subject; and five minutes' examination of the subject would have satisfied them that there could not be the smallest difficulty about it. Instances are before them of common roads, canals, irrigation works, &c., producing an annual return to the country of more than cent. per cent. upon the outlay; and as any amount of money, for making every sort of improvement in India, can be obtained at 5 per cent., the practicability of executing these essential works is undeniable.

The Western road from Madras, constructed by Lord Elphinstone, cost about Rs. 10,000 (£1,000) a mile (with a great waste of money), and the rate of transit has been reduced from four and a quarter to one and a quarter annas, (six and three-quarter to one and three-quarter pence) per ton per mile; and as there are now about 300 tons a day carried along it (besides travellers) there is an annual saving to the country from this work, of Rs. 18,500 (£1,850) a mile or nearly 200 per cent.; and had a canal been cut on the same line for Rs. 20,000 (£2,000) a mile, the traffic would probably have been increased five-fold, and the cost reduced to one-thirtieth of what it is now. Again, Cochrane's Canal, (about ten miles of communication) costing originally perhaps Rs. 150,000 (£15,000) yields Rs. 30,000 (£3,000) a year, or 20 per cent. to Government, besides the saving to the community. Again, the

opening of the Paumbam Channel, which has cost about two and a half lacks (£25,000) has reduced the cost of freight between Tanjore and Ceylon to one-third, producing in the carriage of grain alone a saving of more than four lacks (£40,000) a year, or 160 per cent., besides the reduction of Interest and Insurance from a shorter and safer voyage. Again, *all* the important and some minor Hydraulic Works executed in Madras during the last fourteen years (exclusive of the Godavery Works), have cost in all five and a half lacks (£55,000) and yielded on an average a net return to Government of three and three-quarter lacks (£37,000), or nearly 70 per cent. per annum from the time of their construction; and they are now yielding at least 100 per cent., besides all the profit to private individuals.* These are specimens of the effects of Public Works in India. How can it be otherwise? Does not common sense tell us, that a country in almost its natural state, occupied by millions of orderly and industrious people, must necessarily present openings for the employment of Capital in the improvement of natural advantages, far beyond what can be expected, either in a country like England where all the most obvious openings have already been taken advantage of, or in one like America where there is a deficient population?

And yet, the Court's Despatches imply first, that if the works are executed at all, the cost must be defrayed out of the current Revenue; and secondly, that there is no other way of relieving the country than by paying off the debt already existing. With respect to the first, nothing can be more unreasonable and unjust; it is nothing more nor less, than the man's determination not to go into the water till he can swim. Until these works are executed the Revenue cannot seriously improve; and therefore if we wait for a surplus, we must wait for ever. And what can be more unjust even if it were possible to accomplish it, than to grind out of the present generation, the whole cost of works in which they only have a life interest? If the Capital required for the works be worth only 5 per cent., this is all that can justly be demanded of the present generation; and not one rupee more should be taken from them. Let future generations who succeed to the possession of the works pay their share of the cost by meeting the current demand for interest. Even if there were a surplus Revenue, both common sense and justice show us that the taxes should rather be reduced, instead of such surplus being spent on Public Works of this very remunerative character.

With respect to the second point, *viz.*, there being no way of relieving the country but by paying off the debt, let us suppose that we met a poor famished cooly fainting under a load of twenty pounds from want of food, and had it in our power either to carry his load for him, or by feeding him restore him to his full strength, and enable him to carry eighty pounds with ease; which would be the best thing to do for him? Even if all the

* See Statement Z in Appendix to Madras Public Works Report.

taxes of India were taken off it would still be in a miserable state without Irrigation, Communications, Ports, &c. And to increase the income of the country, twenty-five millions sterling by means of these improvements, would be an incomparably greater benefit than to take off the present twenty-five millions of taxes; and a complete system of communications throughout India, would undoubtedly increase the income of the country by far more than twenty-five millions a year. Let us once more take the case of Tanjore, and suppose that instead of Rs. 40,000 (£4,000) a year being spent on improvements in Public Works, the same amount of taxes had been remitted; the district would, it is true, have had Rs. 40,000 (£4,000) a year less to pay, but it would, on the other hand, have remained without those works which have raised the value of its land to three or three and a half crores (three and a half millions sterling), indicating an increase of income of eighteen or twenty lacks (£200,000) a year. Ask a sick man which he would rather a doctor should do for him; relieve him from a small part of his work? or restore him to his full health, so that his labour would be a pleasure to him? can there be any question which he would prefer? The present debt of India would be utterly insignificant to a fertile country containing 100 millions of people in a state of perfect peace; if only they had the means of cheap transit. It only amounts to half a rupee per head per annum. The improvement in the Revenue of Tanjore alone pays one-tenth of the interest of the debt trifling as the works are that have been executed there, and the increase in the value of private property there, is equal to more than a tenth of the debt; so that if five districts out of the ninety or one hundred were thus positively improved, it would be equal to wiping off the whole debt.

When this point was expressly brought before the Court by the Madras Government, *viz.*, the executing Public Works by means of a loan, it was not objected to, but still, nothing was done about it; the usual fate of all suggestions for the benefit of India. Debt, whether incurred for wars entailing a permanent charge upon the country without any good to counterbalance it, or for the execution of Public Works yielding 100 per cent., or twenty times the interest, is equally called a *burthen;* both are treated alike, and the same reasoning is applied to both, though one is the load on a bullock's back, and the other the wings of a bird, which instead of being a burthen, carry the body. We may safely say that there is in India an almost unlimited field for the employment of Capital that would yield at the lowest calculation 50 per cent. to the community; so that every million borrowed and spent, will, in the present rate of interest (4 per cent.), be equivalent to paying off eleven and a half millions of debt; and this is all the *burthen* it will be to the country. A *burthen* is not an absolute, but a relative thing; and the present debt of India is a greater burthen to it with its one hundred millions of inhabitants, than ten times the amount is to England with a quarter of that number of people,

because India is starved to death and has no strength to bear even so trifling a burthen. A million of people in Berar are paying annually 200 or 300 lacks (two or three millions sterling) a year, for rice which they grow themselves, while they could obtain it from Rajahmundry for fifty or seventy lacks (£70,000), if the Godavery navigation were opened. No wonder they cannot bear the burthen of these taxes when they have to bear this load of 150 or 200 lacks (one and a half or two millions sterling) unnecessarily; whereas, if they could get their food so much more cheaply from Rajahmundry, they might employ their labourers in growing cotton for Manchester. And so also with respect to the sums actually paid for transit. The city of Madras, for instance, pays for the carriage of firewood, &c., at least twelve lacks (£120,000) a year, perhaps as much as twenty lacks (£200,000); nineteen-twentieths of which might be saved by improved communications. With this load, equivalent to two or three rupees (four or six shillings) a head, (more than ten times as much as their share of the interest of the Indian debt), no wonder the people are not able to bear the load of the taxes, light as they really are.

If we estimate the whole loss to India from want of communications at only twenty-five millions sterling, it is still twelve times as great a burthen as the interest of the debt. How is it that there are such endless discussions about relieving India from the debt, and not one word about getting rid of a load, in comparison with which, the debt is very trifling? How much easier would it be to increase the strength of the country so that the debt shall be scarcely any burthen to it than to get rid of the debt; and how much better to have a country in health and strength with a light load to carry than to have a population miserable, sickly and starved, though without a load; even supposing it were *possible* to get rid of the burthen of debt, which it certainly is *not*, excepting by this one means of Public Works. India has been dealt with like a patient by an ignorant doctor, who in order to cure him of some complaint connected with the unwholesome state of his room, persists in physicing him, and thus reduces his strength more and more; whereas, if he would only give the sick man a change of air, his system would gather strength to throw off the disease of itself. What India requires is, *not* more financial doctors; but a change of circumstances. It requires no such physic as the financial Despatches prescribe, but something to invigorate the system; it wants to have the light and air let into it by means of communications. If this were only tried, it could soon throw off its present debt.

Alas for India! whatever happens, war or peace, famine or plenty, success or failure, increase of receipts or falling off, all lead to only one result, all tend to generate the lamentably false conclusion that *nothing can be done* to remedy existing evils. At the very time that a Despatch is written to India, treating with such indifference the subject of Public Works, the boast in England is, that such large sums are expended

on them. The statement above referred to shows, for a period of fourteen years throughout the whole Madras Presidency, an expenditure of only five and a half lacks of rupees (£55,000) or £4,000 a year (one-thousandth part of the Revenue) on new Works of Irrigation or improvements in old ones; and upon this a return of at least 200 per cent., including the benefits derived by the country, is obtained on the whole: and yet, a financial letter professing to submit a view of the whole subject does not say one word about such an astonishing opening for relieving the finances. How often have we thought, "Well, now at any "rate, the real state of the case is proved so that it is impossible but that "it should be rightly understood, and we shall now at length see a real "energetic attention to Public Works." But hitherto we have suffered repeated disappointments; and when we have arrived at the end of 1852, this Despatch shows the results of all the efforts that have been made to awaken the Government to a sense of the importance of these things.

It is indeed heart-breaking work; and the first impression is, what is the use of labouring for the good of India and the enrichment of the Treasury? Is it not much better to leave our rulers to go on in the old way, and India to its famines, poverty and ignorance? But the longest night is followed by daylight at last; and surely there are symptoms of day-breaking already, at least in the North-West. Surely there are manifest proofs of some increase of interest being taken in India by the people of England, and at all events the present enquiry offers an opportunity which it would be the height of folly and wickedness to let pass without an effort to bring these matters more prominently to notice. Many at home now take a real interest in India, and there is a rapidly increasing body of men who begin to see and feel that England also is deeply concerned in the progress of this vast empire, as the prosperity of one hundred millions of British subjects must powerfully affect that of the whole empire; in short that Englishmen are personally interested in India, and that whatever vitally affects that country is their personal concern. This at least gives an opening for hope, that the weight of England may be brought to bear upon this matter.

Manchester especially has made its voice heard, and its power felt in Indian matters; and there is even some evidence that it is sensible of its remarkable power as the proper substitute for a free and powerful public voice in India itself. To its commercial population at least, the progress of things in India is a vital question; whether the country is to be dependent on America alone for cotton and cheap bread, or whether it is to have two strings to its bow, and two competitors for its custom and goods. If Manchester suffers such a state of things as above described without the most determined efforts to bring about a great change, certainly it will deserve to find itself some day deprived of its very life-blood by war with the United States, or some other

catastrophe. India can be enabled to supply England abundantly and cheaply, with two essentials, flour and cotton; and nothing whatever prevents India doing so at this moment, but the want of Public Works. If only the country were, by means of Irrigation, enabled to produce food as cheaply and abundantly as it could easily be made to do, and if by means of communications, its produce could be cheaply conveyed to the Coast, then Manchester is safe; for its supply of the two things upon which its very existence depends cannot fail. But while three-fourths of the people of India are employed in raising food, and an eighth in carrying their produce over the unimproved face of the country at a cost that would instantly paralyze England if subjected to such an incubus, this magnificent appendage to England must be comparatively lost to her, and the prodigious, and incalculable stimulus that it might give to her manufacturing and general prosperity must be in a great measure lost.

The only way that I ever heard this neglect of such a country by her rulers satisfactorily accounted for, was by a shrewd friend, who said, "Sir, the fact is, that such a country with its immense population and "unbounded capabilities would, if it had been managed with the smallest "degree of European energy and intelligence, have thrown such amazing "means into the hands of England, as totally to destroy the balance of "power, and place her so immeasurably ahead of all other countries, "as would have made her mistress of the world." Perhaps now that the United States have made such progress in population, &c., as to form a powerful counterpoise, this cause for India being kept in a state of paralysis is removed; and the time may now have arrived, when England may be safely trusted with the vast accession of power which an active and enlightened management of India will inevitably give her. Suppose all the rest of India had been treated only as Tanjore has been, what could have prevented the same results following universally; the population being doubled, the Revenue increased 70 per cent., and the value of private property quadrupled? And suppose that instead of only the imperfect works that have been given to Tanjore in a long course of years, (half a century) all India, had as fast as it was acquired, been boldly and liberally supplied with the works which are indispensable to a state of life and prosperity; and thus been relieved from a burthen equal to the whole present taxation of the country, and at the same time provided with that powerful stimulus which free intercourse would supply, who cannot see that the addition of such a source of supply for England's manufactures and such a market for her goods, would have placed her in such a position of power and independence as cannot be estimated? How coolly we talk of one hundred millions of people, and how little we think what such a population might be, if roused from their torpor and despondency, brought into a state of life and activity, and united under one intelligent government!

CHAPTER III.

VIEWS OF THE GOVERNMENT AND CIVIL SERVICE OF INDIA ON THE RELATIVE IMPORTANCE OF THE MODE OF COLLECTING THE LAND REVENUE, AND THE PROMOTION OF PUBLIC WORKS.

Views of the Civil Service.

HAVING thus examined the opinions held on these subjects by the authorities in England concerned in the Government of India, let us go on to investigate the views of the ruling body in India, the Civil Service, the actual executives who are to carry out the orders of the superior powers. Are they writhing under the system under which they are employed? Have they from seeing the practical working of these views on the spot, in the poverty, ignorance and despondency of this immense population in the provinces, and the want of everything which should mark the country to be under a powerful, intelligent, well instructed, and energetic European people, with unbounded means at their disposal and above all with the principles of truth and righteousness taught them in the Bible—have these men generally, from seeing continually the fruit of the views of their superiors, become so deeply sensible of the utter ignorance displayed in them, as to be weary of being parties to such a system? Have they been incessantly pressing upon their notice the disgraceful results of such a mistaken system in the actual state of the people? Have they urged upon the consideration of their rulers, the measures unavoidably resorted to, to get out of the people the insignificant Revenue paid by such a multitude in such a fertile country? Have they been continually pointing out, that so long as such a system is pursued, it is impossible that the Revenue should improve, or Government be supplied with the means of improving the condition of the people, and marking the country as having been under the Government of a wise, benevolent and energetic people? Have they said, "We have "now tried for fifty or one hundred years what can be done, by keeping "our eyes incessantly fixed on that one point which we at first learnt from "the Native Governments who preceded us, to be *the thing* on which "all national prosperity depended, *viz.*, the *mode of collecting the Land* "*Revenue*; and we have found that not one single step in advance has

"been made by means of it; that the people are still as ignorant, as "poor, as inert, and as helpless as the day they came under our power. "We have done our utmost; we have screwed out of them the last "rupee that we could get from them, in order to try and show a good "result in the amount of Revenue, and we have utterly failed: and we "must, in every respect and on every occasion, press upon your notice, "that whatever may be done about *collecting*, so long as nothing is done "about *producing* the sources of Revenue, we shall never have a rupee "available for the instruction and improvement of the people."

Nothing could be more to my present purpose than the work lately published by Mr. Campbell, called "*Modern India;*" a work intended to give a complete view of all essential points connected with the country. It is not the work of a man of former days, nor is it that of a man who though really younger, is in fact of the old school in his ideas generally; an opponent of all improvement and a worshipper of evils provided they have only been long in existence; neither has he even been associated with the old school men. On the contrary, he is evidently one of the best specimens of the Civil Service, the governing body; though not a man of unusual talent, he is evidently a sensible, active minded man, heartily interested in the country and in his duties and brought up in a new school incomparably superior to any yet seen in India; a school which has given us the first prospect of better things, and exhibited one of the best indications of honesty, in not being altogether afraid of the public knowing what it is about. A multitude of things have been introduced in the North-West Provinces which are quite new, and looked upon with horror by the thorough old school men, things which beyond all doubt are calculated immensely to improve the condition of India, and indicate an awakening of the mind of the Civilians there, which compared with the torpor elsewhere, is like life from the dead. Now, let us see what is the main point in the estimation of a man who is the type of the best class of the governing body; of the most enlightened, intelligent, zealous, and earnest portion of that body who really hold the welfare of India in their hands. If we search his book through and through, we shall find that this point is nothing more or less than *the mode of collecting the Land Revenue; not* the education of the people, *not* the securing to them a never-failing and abundant supply of food, or the power of transporting the produce of labour from where it is worthless to where it is valuable, *not* the free intercourse of the inhabitants, nor even the diffusion of the knowledge of that religion in which alone the true principles of right and wrong are found; neither in one of these things, nor in all of them together, does Mr. Campbell consider the great means of good government to lie, but rather in this one grand root of all good and evil, happiness and misery, wealth and poverty, safety and danger, *the mode of collecting the Land Revenue!*

Mr. Campbell states that the "Magistrate and Collector is a sort of

local governor." Certainly if he be not so, if he be not the representative of Government in his district in all capacities excepting the Judicial, there is nobody else whose business it is to attend to the various interests and wants of a community such as that of India, who stand in the same relation to their present rulers, as children in a nursery to their grown-up guardians. What they cannot do for themselves, we must do for them. With his magisterial duties, therefore, he is not merely the *Collector*, but the person who should, in the fullest sense of the word, superintend the district; and it is his business to attend to every thing upon which the well-being of the people depends, excepting, of course, Judicial matters. If it be said, "No, this is never intended; his duty is solely to *collect the Revenue*, as that of the Judge is to investigate crime," then it is admitted that Government looks with perfect indifference on the sources of good and evil in the country; considering its sole duty to be, after securing peace, to hang criminals, and pay itself for so doing. But this is totally contrary to all that is said; for theoretically the Government is generally acknowledged to have the whole welfare of the people in its keeping. Even, supposing, however, that the sole business of Government were to pay itself for keeping peace and hanging criminals, it is still a complete mistake to suppose that its officers have nothing to do but to *collect* Revenue, and that the people will, without any aid, procure the means of paying the taxes. If only a thousandth part of the time and labour expended on adjusting and *collecting* the Revenue, were bestowed on the means best calculated to enable the people easily to pay it; the Government would be rolling in money.

But to return to our author. Even meeting him on his own ground, and supposing the ultimate end and object of Government to be simply to obtain a certain amount of Revenue, and that amount to be the sole test of what is done, (for Mr. Campbell winds up his statements of the management of each Presidency by a simple statement of Revenue collections designated as the "Result" of the Ryotwar system), can any thing be conceived more absurd, than to take it for granted that these results are simply the effects of a certain mode of *collecting the Revenue?* A man might, almost as well conclude, on seeing his friend look unwell, that it was because he was wearing a coat of some particular colour. Mr. Campbell takes the general collections of all Madras and gathers from them the *effects* of the Ryotwar system. And yet, amongst these districts, are some that have, upon the whole, made at times, or throughout our rule, steady progress; others that are now in a most wretched state, and others again that had at one time sunk excessively low, but are now to a great degree restored, without these fluctuations having the least reference to the kind of settlement in the districts. But can any one who thinks at all seriously on the matter, for a moment, believe that there are no more powerful agencies at work than the *mode of collecting the Revenue*, even in respect of the amount of that Revenue?

I shall not attempt to go into this subject generally, nor have I the least pretension to be competent to it: the only two points which I insist upon, are; first, that the whole governing body, (of which Mr. Campbell is a type) do in fact, as a body, though, of course, not without individual exceptions, really act upon the principle, that *the mode of collecting the Revenue* is *the one thing* to be thought of; and secondly, that there are in reality many other points of incalculably more importance than this one; and among them the promotion of Public Works.

Let us now take a district under this so-called wretched Ryotwar management, by which every miserable victim is condemned to hold his own land, whether much or little, independent of all his neighbours, and obliged to do whatever he pleases with it, without any other ryot having the right to interfere with him; a thing which would in England be considered an advantage, but in this extraordinary country, is, it seems, the greatest misfortune under which a man can labour. Let us suppose this district, though possessing a fertile soil and partial supplies of water, to be yet in a great measure liable to lose its crops from irregularity of seasons, (sometimes floods, sometimes drought) and also to be for the greater part of the year without any means of transporting its produce, owing to the soil being alluvial, and the rivers unbridged; and further let us suppose that Government immediately on taking possession, begin to expend annually a certain sum of money, either in keeping off floods, leading water in new directions, or opening communications, so as to enable the land to yield a return on the outlay of 200 per cent. Assuming that thirty lacks (£300,000) is the Revenue at first, and that by means of Rs. 40,000 (£4,000) laid out annually on improvements (besides a like amount, necessary to keep up the progress already made) a progressive increase of *income* of Rs. 80,000 (£8,000) a year is obtained; this outlay if continued for fifty years, would cause a total increase of *income* of forty lacks (£400,000) a year. The *Revenue* taken from the district will thus have increased by twenty lacks, (from £300,000 to £500,000) and as it is actually counted into the Treasury, there can be no question about that. The increase of income to the people twenty lacks, (£200,000) is shown by the saleable value of the land having increased by 300 or 400 lacks of rupees (three to four millions sterling), and yielding interest to the proprietors at 5 or 6 per cent. Suppose that one of the ways in which this return for outlay has been obtained, is by supplying 7,500 cubic yards of water to each acre of land at a cost of five rupees (ten shillings) of Capital, whereby an increase of produce is obtained to the extent of ten rupees (£1) a year per acre, more than before. Another is, by laying out Rs. 1,000 (£100) on a mile of road, by means of which fifty tons of goods per day are conveyed all the year round, at one anna (one and a half pence) less per ton per mile than they could previously be carried in the dry season only; being a saving of Rs. 1,000 (£100) a year, besides the gain

by being able to convey the goods in the wet season, and let us suppose the district to be thus provided with 1,000 miles of road, effecting a saving of ten lacks (£100,000) a year in transit alone.* This is a correct statement of what has been done in Tanjore, and will enable any person to understand how, even under a wretched Ryotwar system, a district may stand Mr. Campbell's test, and show a very comfortable increase of Revenue; and such an improvement as would, if extended over five districts only, meet the average balance against India of one million a year, for the last thirty years.

On the other hand let us take another district, under Zemindary and Village settlement, where almost every farthing collected, (except what is expended on collection) is sent out of the district; where the old and partial means of securing a supply of food are left to go to ruin, and not a mile of road made in it; not a reservoir of water constructed; not an embankment thrown up to prevent the river drowning any extent of crop, and not a stream bridged: so that almost its produce except what can be consumed in the village where it grows is utterly valueless. Besides this ordinary state of things, let us suppose a failure of local rains to occur, which, in consequence of its being unmitigated by a single tank of water, or a single channel leading water from an unfailing river which borders the district for eighty miles, gives rise to the utmost horrors of famine, sweeping off in a few months fully half of the population, and reducing the Revenue at once by fourteen lacks (£140,000) a year; a loss which is not fully recovered for twelve years. Now, this is a correct statement of what has happened in Guntoor. Does anybody find it hard to understand how any kind of *settlement* would have failed to make this a flourishing district? Let any gentleman in England manage two estates in these two different ways. Let him manage one Ryotwar, letting it out to a number of small and large farmers independently, and expending a portion of the rent every year upon it in such a manner as to make it more productive to the extent of $2\frac{1}{2}$ per cent. than previously, while he only raises the rent $1\frac{1}{4}$ per cent.; and let him manage the other by giving all his tenants a joint lease of it, but take the whole rent without expending one farthing on repairs or improvements; let him continue this for fifty years, and then take his friends to see the *results of his two modes of settlement* with his tenants.

Now, let us suppose as regards Tanjore, that instead of the petty trifling way in which it has been improved, a really intelligent and vigorous system had been pursued. Suppose, for instance, that instead of Rs. 40,000 (£4,000) a year, even one lack (£10,000) only had been spent in irri-

* Besides these ordinary advantages let us suppose that the district were, once in twenty or thirty years, when the whole Carnatic is deprived of its usual local rains, enabled in consequence of the care taken to provide it with water, to sell nearly half its own produce at enormous prices to all the surrounding districts, thus nearly doubling its income for that year, instead of sharing in the general calamity, and having to import half its food at a high price.

gation improvements, so that the district had been brought into tolerable order in that respect in twenty years instead of fifty; and that by continuing the expenditure sufficient water had been stored up to supply it throughout the dry season, and thus enable the people to grow sugar and other valuable products, instead of being as now, without water for four months, and growing rice only. Under the former system the district might long ere this have been exporting 100,000 tons of sugar a year, worth 200 lacks (two millions sterling) besides various other things. Let us suppose further, that instead of merely constructing in the course of the latter thirty years of the fifty, very imperfect unmetalled roads worked at three annas (four and a half pence) per ton per mile, a system of steam canals, by which goods could be carried at half a pice, (one-sixteenth of a penny) per ton per mile, had been commenced from the first. At present there are just 1,000 miles of road in the district; and supposing the average traffic to be equal to fifty tons of goods a day, the daily cost must be Rs. 9,000 (£900) or thirty-two lacks (£320,000) a year. If steam canals had been provided for the great bulk of the traffic, this would have relieved the district from an expenditure of twenty-five lacks (£250,000) a year on the goods and passengers moved; besides at least an equal sum being probably gained in the additional value given to goods which are now not moved or sold at all, on account of the present high rates of transit. With these improvements an additional income of at least 100 lacks (one million) in more valuable products would have been gained, and a saving would have been effected in transit, worth fifty lacks (half a million) a year, so that the Revenue might now be 100 lacks (one million sterling) instead of fifty lacks, (half a million sterling) and the net income of the people also 100 lacks (one million) more than at present. And all this might have been done without a rupee (two shillings) being permanently withdrawn from the General Treasury; for the district would itself have more than repaid the outlay for all these improvements from year to year, out of the additional Revenue it would have been yielding; just as of late in the Rajahmundry District, where, while twenty lacks (£200,000) have been spent in eight years, thirty lacks (£300,000) of additional Revenue have been received. No reason whatever can be assigned, why this should not have been done, and thus this one district been enabled instead of paying £200,000 a year in mere Revenue towards the late annual deficit of a million, to pay £700,000 or seven-tenths of the whole deficit; and only two districts so improved, would have made the difference of our having for the last thirty years a surplus Revenue upon all India of half a million sterling, instead of a deficit of a million. And I think we may venture to say this would have been the case even under the Revenue system which, according to Mr. Campbell, is the worst in India; that is, even if every land owner had been compelled to manage his own land in his own way, and without the interference of his neighbours.

Is it not astonishing that sensible men can be so blinded as to imagine that every thing depends upon the *mode of collection of the Land Revenue* throughout India? When a district that pays twenty lacks (£200,000) a year in Revenue, is paying the same for transit or for want of transit, who cannot see that there is at least one thing of more importance than "the Settlement?" I have brought forward most prominently this point of Public Works; but it is only *one* of many, all of which are of a hundred times more importance than "the Settlement." Take, for instance, Education. Suppose some "Collector" had taken it into his head, that an intelligent and instructed million of people would be better off in every way than a million of people raised very little above the beasts, in fact as entirely without anything that can properly be called knowledge, as their bullocks; and that under this idea he had everywhere established schools where all fundamental knowledge could be acquired in the vernacular languages—what would be the state of his district by the time a generation had grown up? Suppose further, that he had been so fanciful as to think that it might even be of some use to them to know the true principles of right and wrong, of truth and falsehood, and had caused them to be instructed in the only religion where they were to be found, so that instead of falsehood being almost invariable, and truth scarcely known, his district had been brought up to the standard of England; so that when a Judge entered upon a trial, he could stand upon the ground, that it was ten to one the evidence he heard was true. Suppose a district under such a system as this, and consider whether the people might not be better off upon the whole, even under a miserable Ryotwar settlement like that which England groans under, than under a Village settlement, but without any knowledge or right principles? Nothing is more certain, than that it is quite possible, not only for an individual, but for a whole body, thus to have their attention so fixed upon some comparatively insignificant point, as altogether to lose sight of a hundred other things of incalculably greater importance; and until the governing body are driven out of this strange infatuation, the progress of India must be slow indeed.

Let any person only consider the countless volumes that have been written on this frothy question, "What is the best mode of collecting the Land Revenue;" not merely by inferior men, but by our very ablest Governors and Collectors, from Sir T. Munro downwards; and can he fail to be astonished beyond measure at the way in which this matter has been treated? It was originally purely a Native idea, and is a perfect specimen of the operations of the Asiatic mind; similar to the notion of the Brahmins, that a man's eternal happiness depends upon his never having trodden upon a bit of leather, without purifying himself afterwards. Of all the sad and depressing things continually before our eyes in India, one of the worst is, to see the Anglo-Saxon who has been born and bred in an atmosphere of freedom and knowledge in which his

mental vision has expanded and strengthened beyond anything before seen in the world, allowing his mind gradually to shrink and contract, until he at last comes to think the poor wretched ideas of the bookless Asiatics, the height of wisdom. Thus daily to witness the mental deterioration of fine intelligent young men, is indeed most melancholy; and yet, there is nothing surprising in it. The young lad, on entering the Civil Service in India, is sent to some remote place, where he sits from morning to night surrounded by his slavish Native Cutcherry servants; and continues immersed in this poisonous atmosphere day after day, and year after year, with but very little intercourse either with Europeans or with books. Under such circumstances, how should anything better be expected than that without being in the least sensible of it himself, his mind should become more and more dwarfed, till he really sees things with Natives' eyes? Of course, a few active-minded energetic men keep themselves to a considerable extent above this influence; but I can safely affirm, that until of late years, there was hardly an individual in the Civil Service who had not been more or less grievously injured in this way, and I confidently appeal to the state of India at this moment, in proof of the assertion. Is it at this moment in an Asiatic or a European condition? How is the time of a *Collector* occupied? What portion of it in matters immediately connected with the collection of the Revenue, and how much on matters calculated to raise either physically and mentally, the state of the people?

To an Engineer in India intent on Public improvements, the thing that continually weighs him down is, that he cannot but feel at every step that he is transacting business with men, who relinquishing their English notions, are imbued with Native views of things, imbibed with the air they have breathed in Cutcherries, for ten, twenty or thirty years. Do these men think that the welfare of the people depends upon their having correct principles, and knowledge of right and wrong, books, means of intercourse, and the power of exchanging commodities, or upon a proper division of labour, whereby only a small portion of the community are employed in producing the actual necessaries of life, while the rest are thereby set free to prosecute arts, sciences, learning, &c.? Not in the least; these are matters of no importance in their estimation: *the question* is, "How is the payment of the land-tax arranged?" They do not even consider it a matter of any moment, compared with the *mode of collecting*, whether by facilitating the production and transport of food and manufactures, the *income* of the *district* might not be increased tenfold; that is, whether the Revenue drawn be one-fourth, or one-fortieth of the *income* of the people. And yet, these are all Englishmen who know that our national prosperity and strength are the results of the enormous economy of human labour by means of Public Works, whereby only a few are actually employed in providing the mere necessaries

of life, (food, clothing, and shelter), thus leaving a large number of the people at liberty to promote learning, arts, &c.

Until this erroneous idea that *the one thing needful* is the *Revenue Settlement*, be given up, nothing can be done. Till the attention of the Civil Service is turned to the *sources of income*, and the circumstances of the people thus improved, we shall be met at every step as hitherto, with the invariable answer, "*We can't afford it*," and there will be no education or any thing which can really elevate the people. One of the first and fundamental things is, by means of Public Works, to increase the income of the country; and this is entirely within our reach, since any amount of money can be obtained from without, for the execution of improvements which will pay ten or twenty times the interest of the Capital. There is not a shadow of ground for delaying these things one day, and they will naturally place at the disposal of Government funds for every other purpose. If the increase of Revenue in Tanjore were not all carried off to supply the deficiencies of the districts which have been utterly neglected, there will be abundance of means there for every purpose. If it paid only its share of the current deficit, (in addition to its original Revenue of thirty lacks (£300,000) which may be taken at 1 per cent. on a million sterling, or one lack) (£10,000), there would still remain nineteen lacks (£190,000) available. One-half of this, say nine lacks (£90,000), might be at once given up to the people, by abolishing such items of taxation as are most burthensome, and ten lacks (£100,000) would still remain for education and such other things as could not yield a direct return in money. At the same time, all sorts of works which could conveniently provide a direct income to cover interest, should be carried on without stint by means of borrowed Capital. For instance, a canal capable of bearing steamers of 300 tons should be cut through Tanjore, and extended to Madras and the Western Coast, thus throwing the district open to both Home and Foreign trade. Such a work, if executed for Rs. 20,000 (£2,000) a mile, would produce a saving of at least Rs. 30,000 (£3,000) a mile per annum, taking a traffic of 240,000 tons at two annas (three pence); and hence after paying Rs. 1,000 (£100) as interest, the income of the district would still be augmented by Rs. 29,000 (£2,900) a year, for each mile, or twenty lacks (£200,000) a year on one main line. The great mass of trade being thus provided for, to be carried at an almost nominal price, Tanjore would soon be rich enough to afford to have high speed for travelling and conveyance of valuable goods, as in England. Another portion of Capital might be borrowed for the purpose of providing water by storing in reservoirs, for the summer irrigation; and so on.

The district being thus enriched, its income increased from 200 lacks (two millions sterling) a year to 300 or 400 lacks (three or four millions sterling) and the Revenue reduced from fifty to forty lacks (from half a

million to £400,000) by the removal of burthensome taxation, what would then become of the great question, *the mode of collecting the Land Revenue?* This would be found to be easily settled, when the amount was only 10 per cent. of the income, instead of 30 or 40 per cent., as at present.

By the way the Tanjore District affords a curious comment on the endless discussions about "*the Settlement.*" For twenty years past, one-half of it has been settled Ryotwar, and the other half Mouzawar; and there is no difference to signify between the condition of the two. The same is the case also in two divisions of Mysore. In Nuggur, the old Native system was almost entirely abrogated when the country came under British administration, the Ryotwar system introduced, and other changes of the same sort made: whilst in Chittledroog, the old village system, with division of the crop, &c., was continued. In both, the Revenue has increased very much; quite as much in the latter as in the former; and the improvement is chiefly attributable in the first place, to steady and honest government; secondly, to European superintendence; and thirdly, to the attention given to roads, tanks, &c.

A new work, entitled "*India as it may be,*" has recently been published by Mr. Campbell; in which he attempts the harder task of setting things to rights. Nothing is clearer to me, than that no Indian Civilian can possibly do this. The man who could write Mr. Campbell's first book, has proved that no one of his class can accomplish the object of the second. His whole head must be emptied of its present views and notions, before it can possibly find room for such as are required to enable a man to make India "*what it may be.*" Witness one single specimen of Mr. Campbell's ideas, in the opinion that gagging and secrecy are essential to good and effective government. We are to believe that he *would prefer* being compelled by his superiors to pass among his fellow-countrymen and Native fellowmen, as a man of infamy, rather than run the risk of a system of publicity. And, of course, the man who could thus allow himself to be degraded by his superiors would act on the same principle towards his subordinates, and prohibit them the right of justifying themselves in the sight of their fellowmen. Is it not astonishing that in our day men can be found—*Englishmen*—who dare publicly to declare, that such is their fear of publicity, that they will rather submit to the most degrading position than have their conduct openly discussed? Rather allow any stains upon their character, than be liable to such a publication of their official acts, as will enable their fellow-rulers and fellow-subjects to judge of their conduct generally? Need we enquire one step further to satisfy ourselves of the utter unsoundness of a system which leads men to prefer anything to the light? "He that doeth truth cometh to the light that his deeds may be made manifest." Is it not enough to make a man ashamed of his country

and service, to see such principles openly acknowledged? Any man may make great mistakes from want of judgment, &c.; but if he be honest, he will never be afraid of publicity. The system of gagging their servants at once stamps a Government as unsound and dishonest; and those who are slaves as subordinates, are surely training for tyrants when they get into power. This secrecy is one of the blights under which India has withered hitherto, and so deeply rooted is this principle, that it can never be eradicated but by a power from without. What thousands of abominations are daily perpetrated, that could not stand one moment's exposure, if liable to it immediately after the act! A man stands up and confesses himself the author of such an atrocity as the Afghan War after an interval of some years, but he dare not have looked his country in the face if his agency in the matter had been discovered soon after the war had been entered upon. The grand check upon evil must be the liability to seeing it all in print the next morning, and the knowledge that all the facts will be made known to every body before the interest of the matter is lost. How wonderful it seems, then, that any body of men can be so misguided as openly to declare that they dare not have their official acts known and canvassed; thus admitting that they are bent on doing things which will not bear the light.

If we examine Mr. Campbell's system of Finance, we find it equally unsound. *If* he can get an additional million out of Oude, *if* he can reduce the Military Establishment by two and one-third millions, &c., (observe how tenderly he deals with the Civil Service, who are only to surrender one-twelfth of what the Army is to give up), *if* he can thus obtain a surplus income of four millions, *then* he will put all to rights. All this is mere speculation; we know very well that there is not the slightest probability of reducing the Army or plundering Oude to this extent, or anything approaching to it, and so there is an end to the whole scheme; and he might have just as well have suggested nothing. About the *sources* of Revenue, Mr. Campbell scarcely says a word; though he has, it is true, at the end of his book, a few pages about Public Works, just enough to show that he totally misapprehends the whole matter, as is universally done by the Civil Service. He indeed ends his book with this notable discovery, "Without money we can do nothing;" a conclusion which a man might arrive at without reading the volume through and without any great genius. If, after reading Mr. Campbell's book, we had been rewarded by being informed, *how* this money was to be got, it would have been more satisfactory. If somebody would only take up the matter where Mr. Campbell leaves it, and proceed to show how to improve the *sources* of Revenue, he would do us better service. Why are the people so poor at present? Because, being entirely without any means, excepting bullocks, which can be substituted for human labour, it is as much as they can do to feed, clothe and shelter themselves; or rather, I should say, *more* than they can do, at least while

they have to keep their rulers in luxury. This is the plain indisputable answer to the question. On the other hand, why is England rich ? that is, why has it the means of supplying itself with a thousand things beyond the mere necessaries of life ? Because, while it contains only twenty-five millions of people, there is as much done by the aid of Steam, Water, Roads, Canals, Railroads, Ports, Docks, &c., as could be effected by the labour of perhaps 200 millions of people; and having, therefore, the work of that number, while the necessaries of life are required for only one-eighth, there is, of course, an enormous surplus of wealth exchangeable for other things. And this is not peculiar to one country; for, if besides the labour of 140 millions in India, we had the work of another 500 millions performed by means of Roads, Canals, Railways, Water, Steam, &c., there would be in India also abundance of labour available for other things beyond the necessaries of life, and, consequently, abundance of wealth.

Now, where is the difficulty ? Thousands want to lend money at 4 per cent., thousands of Europeans and Natives want employment as superintendents of Works, &c., thousands of Iron Manufacturers and others in England want a sale for their goods, lacks of people in India want employment as labourers and artificers, millions of Ryots want water for millions of acres; tens of thousands of miles of communication and the means of carrying produce need to be constructed, and thus millions might be expended so as to yield ten, twenty or fifty times the interest paid for them. Every thing is ready except *one thing* ; but here we encounter *the* difficulty which has kept India immersed in ignorance and poverty from the day we commenced our rule up to this day. It is this: *that Englishmen, instead of teaching the Natives of India the things which make us what we are, sit down to learn of the Natives the things that make them what they are.* How wonderful it is that a man who, if he were in England, would be certainly engaged in furthering every thing in which England glories, should, in India, occupy himself from morning to night with this notable subject—*the settlement of the Land Revenue of his district.* He sees, for instance, that his district is paying ten or twenty lacks (£200,000) a year for the transit of goods, and that it cannot find a sale for what it produces for want of the means of sending it to places where saleable; and yet he is completely at a loss as to what can be done to relieve and improve it. He turns again to the "*Settlement*," and tries once more what he knows has been tried a thousand times before in vain, *viz.*, how to make a district steeped in poverty pay additional Revenue without increasing its resources. He sees and hears of Capital employed in almost every kind of Public Works yielding 50 or 100 per cent.; he sees the people of his own district producing for themselves certain articles of food, clothing, &c., at double or treble the cost for which these could be procured from another part of the country if there were but cheap transit; whilst other districts are wanting, and paying double or

treble for things which could be got far more cheaply from his district; and yet he cannot think of any thing to enrich the people except giving a little more time to the "*Settlement*," or reading a few more thousand sheets of paper on that everlasting subject. Here is the real and the sole difficulty; but to remove it, one word from our rulers is all that is required; every thing else is ready, and has long been ready. Let them only open a Loan for twenty millions to begin with, order the expenditure of three lacks a year in every district, purchase a million tons of rails and such other things as can be got at once for money and will help towards *the improvement of the resources of the country*, and the whole difficulty is got over. This might be done to-morrow; it is only necessary that what has been so well done by the Governor-General about the Telegraph, be applied to every thing else of this kind; that is, to say "Let it be done." But like every thing else that has ever been done to promote the real welfare of India, it must come from without; for all past experience shows how little hope there is of its coming from within.

CHAPTER IV.

NECESSITY OF ANGLICIZING THE SYSTEM OF GOVERNMENT.

Old Indian Ideas the Destruction of India.

THERE is a great deal of talk now about the necessity of having the Court of Directors filled with old Indians. Old Indians are the destruction of India. A few indeed are necessary on account of their knowledge of Indian matters, but what is wanted is a great majority of untainted Englishmen; Englishmen who are not turned into Asiatics. India never can make a fair start in the race of improvement till old Indians are in the minority among the ruling body. What is wanted is, representatives from different classes in England, who will bring their English energy and understanding to the work. They would make mistakes no doubt, but they would not make *the* mistake of ruling India on Indian principles and notions. Hopeless must the case be while the ruling body is only recruited by Indians, and those old Indians too. Who cannot see that while we have only old men and old ideas connected with the abominable state of things which has so long existed in India, there can be nothing fresh, nothing vigorous, no life in the system of Indian government. In looking back on the past history of India, have we so much reason to be satisfied with the results, that our grand plan should be to perpetuate old views and ideas? To say nothing of the certain effects upon every man, of thirty, forty or fifty years of life in India, one of the great curses of Indian service is, that nobody can be in any situation of influence till he is quite past his best days. It should be considered that a man of fifty in the Indian service is on an average quite as old as one who has passed sixty years in England; and what would be the state of England if no man could be in either of the Houses of Parliament, or in any important office of Government, until he was past sixty; especially in such days as these, when the progress of things is so much more rapid than it ever was before? Only let it be remembered that all those in Council, in the Boards, or at the head of Departments, are men of thirty, forty or fifty years' service, who have undergone the wear of an Indian climate for that time; and that most of the Members of the Court of Directors are of the same class in age, and who can then

feel surprized that we are *rather* behind hand, and that we have plenty of counsel, but very little action? A matter comes before an old worn-out Board; it is sent on to a still more worn-out Council, and it ends with a Court, whose chief boast is that it is composed principally of Members a little older still. Is it surprizing that India perishes for want of *action?* What we want is, that in every branch of the Government there should be a large proportion of men in full possession of all their energy and activity. In England every thing is kept alive, because men in the prime of life meet on equal terms with those who have had long experience, but have lost much of their energy; whereas in India a man must not speak till he is long past his best days.

What is the inevitable consequence of such a state of things? just what we have always had: a miserable, dwarfed system of proceeding, which makes us the contempt of the Asiatics themselves. The only counteracting thing is, that we have often had young Governors and Governors-General, or at least men who, though of considerable age, have come out with all their energies unimpaired by a long Indian residence, and with their fresh English notions. But when our edifice of senility has been capped with a real old worn-out Indian, the consequence has been melancholy indeed. A sprinkling of men, fresh from England, young enough to be in full possession of all their energies, would be invaluable in the Boards and Councils of India, notwithstanding their want of Indian experience; and some change of system, providing an opening for those to be heard, who, though young in age and in the service, are men of talent and energy, is essential to the vigorous government of India. At present, whatever a man may be, he is kept down till his time is gone by before he can be admitted into any place of importance in the Government. What numbers of men of talent, who would have been invaluable if they had been Heads of Departments at thirty or forty years of age, have been kept in insignificant posts and not allowed to speak till they were so much shaken in constitution, that they were fit for nothing, and have then taken an appointment in a Board or in Council, as a place of rest. What we want is, *action;* we have had *counsel* till India is a standing disgrace to England; now let us try another plan. Instead of Falstaff's proportion of bread to sack, let us have a little more *action* and a little less *counsel.* It would be strange indeed if any proposition, however good, should survive, if it has to run the gauntlet of all the "*buts*" that it will encounter from the scores of old Indians it has to pass in the Boards, Councils and Courts, that are arrayed against it. Any one stolid old school man among the whole may succeed in effectually arresting and strangling the wisest project. How many undeniably essential things, declared to be "excellent plans" by all the Boards and Councils, have received their quietus from a single "*but*" from some dreaming old man, who just wakes up enough to remember that there was nothing of that sort when he was a "Collec-

tor," and thinks therefore that the only safe plan is not to run the risk of attempting it.

Thus it *has been*, thus it *is*, and thus it *ever will be*, till there is some fundamental change in the system, both in England and India; and till people begin to consider that though "*counsel*" is a good thing, yet that "*action*" is essential. Some children were walking with their nurse, and they came to a cottage. "Oh," said the children, "where is your "favourite old hen that used to sit so well." "She sat rather too well, "master." "Too well, how could that be." "Why, she did nothing "but sit. She had grown so old that she had not warmth enough to hatch, "so I got a younger one. To be sure she is rather careless, and breaks an "egg now and then, but she hatches the rest." Thus India has been sat upon for fifty years, but as yet there are no signs of hatching; not a chirp has yet been heard, and if more warmth be not applied soon, we must not be surprized some day to find that instead of life, we have under us nothing but corruption. The present state of things cannot possibly continue very long. For my part, so heartily sick and ashamed am I when I look at the present wretched state of these millions so long under the Government of a Christian and civilized nation, that I should like to have an Act passed, that no man who had been more than fifteen years in India should be in Court, Council, or Board, either Governor, or Head of a Department; and that at least half should never have been in India at all. Something however must be done to eradicate the old effete system and to substitute in its place an honest, manly, open, vigorous one which shall not compel men to issue orders proclaiming to the world that they are afraid of being found out; one which shall place the country twenty years hence in such a state that we shall be able to point boldly to it and challenge the world to deny that its millions have been in every way immeasurably benefited by our rule. We have indeed nominally a free Press now, but the liberty to publish what nobody is at liberty to send for publication, is a very negative sort of freedom. "But," says some one, "Would not a greater "degree of freedom give too much license to the corrupt, degraded, "insolent Indian Press?" To meet this friend on his own ground, I would say, gas and oil sometimes remind us that the town is not lighted with amber; but still honest men, when they can't have the light of the sun, prefer these imperfect substitutes, to leaving themselves entirely at the mercy of thieves and cut-throats. Monopolists would gladly cut off the supplies from the newspapers, just as London thieves would gladly cut the gas pipes; not that they are afraid of the thing itself, but of the light that it produces. An honest man even may now and then find the gas-light inconvenient; but upon the whole, as he is conscious that he has no intention of injuring his neighbour, he accounts it an inestimable benefit. At present as things are, Editors are cut off, as far as the power of the governing body goes, from all authentic sources of information

and are then reproached for misrepresentations. People do not consider to how great a degree matters are kept in a healthy state in England, by the degree of publicity which obtains; and so long as India is deprived of the incalculable advantage of a watchful intelligent public being informed every morning of whatever was done the day before, such revelations as we continually have of Indian matters, when it is too late for them to be of any use, must be expected. A certain Governor of Madras, who, when something was suggested to him, said, "Oh no, that won't do, "the newspapers will make such a fuss about it," showed how much more effectual a check is the fear of immediate publicity than any organized superior authority.

It is not in fact *mis*representations that are dreaded; it is *representations.* Persons who dread publicity do not want to know the real state of things in the country; nor do they want the people to know the state of things in their offices. Who ever heard of a Collector eagerly taking advantage of the residence of European Merchants, Manufacturers, Missionaries, &c., residing in his district, and in daily contact with the Natives about the ordinary affairs of life, to obtain information from them as to the real state of the Natives, the real effect of his proceedings upon them, and the conduct of the subordinate officials? In thirty years I have never known an instance of it; whereas I have known a man give to a Collector most valuable and important information, which had not the slightest chance of ever reaching him otherwise, surrounded as he is by a phalanx of Brahmins; and the only acknowledgment the informant received was a most impertinent and over-bearing reply. On one occasion the Government were informed that some lacks of rupees were deficient in the cash chest of a Collector. What can a Government do with such vile *mis*representations? And after the district had been some years longer under a man who could not, of course, check corruption of which he himself set the example, a deficiency of eight lacks was discovered. If a man will praise every thing, declare that nothing could be improved, that the Natives are rolling in wealth, that every district is a garden, that trade is everywhere in a most vigorous state, that all the old Public Works are in perfect order, that no roads, bridges, tanks, channels, ports, &c., are required—then, every word he says is true, and he is a most worthy man. But if he tells the real state of things, he is a vile *misrepresenter;* and if he points out how the state of things may be improved, how the Treasury and the people may be enriched, how abuses, oppressions, and corruption, may be checked, he is a troubler that must be put down. In such a state of things as now exists with respect to India, how incalculably important is the present Parliamentary enquiry; when those who are so anxious to shut their ears must be compelled to hear, and to know that all England hears the truth respecting it; and with what earnestness should all the real friends of both England and India improve so inestimable an opportunity!

I cannot but hope that these papers, which though roughly and hastily written, are the fruit of thirty years' experience and active practical acquaintance with the subject of Public Works in India, and of constant contact with the Natives in their villages, may with God's blessing, be of use in stirring up the friends of India to consider the point. It may be said that Public Works are very secondary matters, and that after providing for the protection of the country, Civil and Judicial affairs are after all the great things to be attended to. The question of Public Works is, however, in reality a fundamental point; for upon it and upon it mainly depends the capability of the country to supply funds for every purpose, both Military and Civil. Without Public Works the country must remain sunk in poverty and ignorance, for funds cannot possibly be produced from the country itself to provide for what is necessary to elevate and improve the state of the people; whereas, with Public Works, the most abundant funds can be obtained for any purpose. We have now proofs of the effects of Capital expended in almost every kind of Public Work. The Paumbam Channel, between Ceylon and the Peninsula, has been deepened from five to ten and a half feet, and it has reduced the freight between Tanjore and Ceylon, six rupees (12 shillings) a ton, which on the 70,000 tons of grain alone, is a saving of more than four lacks (£40,000) per annum, while it has cost in all only two and a half lacks (£25,000). The opening of this Channel has also led to a complete change of the system of navigation, by substituting good keeled vessels that can work to windward, for the old Native tub that could only sail before the wind; this is a case of Coast improvement. Tanjore has been irrigated and drained, and provided with common roads and bridges, at an outlay of twenty lacks (£200,000) in all (besides repairs); and both the Revenue and net income of the people have increased by at least that amount *annually*. The Western road from Madras cost about twelve lacks (£120,000) and the cost of transit on it has been reduced to one-third; producing a saving on 100,000 tons a year over 125 miles, of fifteen or twenty lacks (£150,000 or £200,000) a year. The Northern Canal, which probably originally cost about Rs. 1,50,000 (£15,000) is now yielding a Revenue of Rs. 30,000 (£3,000), besides the saving to the community. A set of works for the improvement of Rajahmundry are well advanced; consisting of a weir across the Godavery, with navigable and irrigating channels, &c. They have been in hand seven years, and about twenty lacks (£200,000) have been spent up to this time, including repairs, and the Revenue has increased steadily from an average of nineteen lacks to twenty-five lacks (£190,000 to £250,000) giving a total increase of thirty lacks (£300,000) against twenty lacks (£200,000) expended; and this besides an enormous gain to the people. So that this vast system of works, which, when completed, will have cost twenty-five lacks (£250,000), equal, allowing for the difference in the value of money, to nearly one-and-a-half millions ster-

ling in England, has been carried on not only without demanding a rupee from the General Treasury, but with a clear surplus of ten lacks (£100,000) of Revenue, besides vast benefits to nearly a million of people; and promising to yield, probably within a few years, a permanent increase of Revenue of ten or twenty lacks (£100,000 or £200,000) a year; for not a quarter of the land is yet fully watered. These are undeniable facts.

I should observe, that in all my calculations about returns, I keep entirely separate the two questions, what are the actual profits of a work to the community? and what may be the profit realized by the Government if they undertake a work? for it is most essential that these things should be kept perfectly distinct. Our great question is not that of a speculator or Company, "what will be the individual gain?" but "rather, what "will be the total benefits to the community?" When we have formed some tolerable estimate of this, then we may proceed to consider the second point, "what proportion of those profits may it be advisable to "carry direct to the Treasury?" In many cases it is clearly advisable not to take any, but to trust to the indirect effects of a work upon the Revenue, to pay the interest of the money expended upon it. This, I think, is the policy with regard to common roads and canals, leaving them entirely free, and the traffic burthened only with the bare cost of transit. Of course, it is clearly desirable that when such a work is executed, the greatest possible use should be made of it, and the smallest toll, to say nothing of the evils of interference, necessarily prevents some things being carried along it that would otherwise have the benefit of it; and there are special and palpable evils connected with levying taxes on goods while in motion. The general principle of taxation should be, to take duties only when goods are in store, or are being stored, so that the owner has time to complain or appeal. In the case of irrigation to land, on the other hand, when taxes are to be levied at all events, the additional tax causes no extra expense in collecting, or additional interference with the owner. In some cases also, it may be advisable merely to take so much as to provide for the interest of the money, and in others it may be a good opportunity to make the work a direct source of Revenue to the State. The State of New York is doing this with the Erie canal, but I must think this a very questionable policy in the case of a canal.

There is also a question as to the policy of levying a toll for the purpose of reducing the debt on the work, but I think this might, perhaps, be advisable where tolls are levied at all. For instance, if 4 per cent. be the rate of interest, and if by levying tolls amounting to 5 per cent., the principal would be paid off in about thirty-five years, then this toll might be advisable; and, considering the enormous benefits yielded by most Public Works in India, it would form no very heavy charge upon them if sufficient were levied to pay off the Capital in ten or fifteen years.

One of the most important points to be kept in view in these matters is this, that in a country so much in want of Capital as India, the real cost of a work to the Government is very far indeed from being equal to the amount involved in it: for it is impossible for Government to spend a lack of rupees (£10,000) in a district without the existing Revenue immediately feeling the effect of the expenditure to a great extent. So much so, that I am inclined to think, from what I have seen, that such expenditure is, even at the very time, little more than nominal, so far as it is spent on the spot. The people generally, and especially the Ryots, are so paralyzed from want of Capital, that every rupee that comes into their hands enables them to do something which shall return them 50, or even 500 per cent., in improving cultivation. So that the effects of a lack of rupees spent on Public Works is, first, to find work for men who would otherwise be employed in the dry season to so little purpose that their food is almost a dead weight to the community; and, secondly, by providing purchasers for produce, to put it in the power of the Ryot to extend his cultivation and pay additional land-tax. On this account there would assuredly be an immediate and most sensible relief to the Finances, by the mere expenditure of twenty millions of borrowed Capital in the country, quite independent of the direct returns.

The essential fundamental principles that should be kept in view in the matter of Public Works for India are, in my opinion,—

1st.—That on no account whatever should money be taken from the current Revenue, to be spent upon them; it being quite contrary to every principle of reason and justice to make the present generation pay the principal for works, of which they only have a life-use.

2nd.—That the account of all expenditure on Public Works should be kept entirely distinct from the current disbursements of the country.

Till these two principles are acknowledged and acted upon, I can see no hope for India. The current Revenue never can provide money for great Public Works; and to make the latter wait for the former, is to put the cart to draw the horse. The Revenue can never produce Public Works; and nothing but productive Public Works can create an increase of Revenue. But how wonderful it seems, to be obliged to put such things as this on paper! Is there an Englishman who does not know, that if the people there had waited till the Revenue provided money for Public Works, they would have waited till now? Out of the hundreds of millions that have been expended in England on roads, canals and railroads, on lighting, paving, and sewers, on docks and harbours, on lighthouses, and a hundred other things, what percentage has been paid by the generation who executed them? Is not ninty-nine hundredths of all the Capital expended on those works, a debt to this day? And is it a burthen to the country? It is a burthen which adds five lbs. to the weight the country carries, and fifty lbs. to its strength. It is

like the load that a traveller carries away, when he stops at an Inn and eats a pound or two of dinner. It does not hinder him much from carrying any other burthen he may have. In fact, it is John Bull's Public Works that enable him to carry a national debt, which would break the back of any one of his friends on the Continent, who have not got so much in their stomach. Ask Tanjore how she would like a bargain obliging her to carry her own debt for Public Works together with their profit; paying only 4 per cent., Rs. 80,000 (£8,000), a year on the twenty lacks (£200,000) they have cost, and doing what she pleased with the twenty lacks (£200,000) a year of additional Revenue they have produced; and see if she would account it laying an additional burthen upon her? Call upon Rajahmundry also to pay her old Revenue, as well as the interest of the cost of her works, but at the same time allow her to keep the profits, instead of, as at present, paying an increased Revenue to Government as the produce of these works; and see if she would not gladly make the exchange. What can be the reason then that principles which no man ever dreams of applying to England, should be applied to India by all sorts of people?

As regards the second of the above two principles, what better can be expected than utter confusion so long as the salary of the Governor-General, and the cost of a canal or tank, are added together! How can any body tell what they are doing, while such absurdities are committed! A tank or canal is just as much *bonâ fide* property as the rupees spent upon it; indeed much more so, for the latter while hoarded up (as millions at present are in the Treasuries) are of no use to any living being. Imagine a man saying, "I was very rich once, I had £10,000 in a box in my "house, but now I am a beggar; I spent it all on this estate which "yields me £1,000 a year." The Governor-General's salary is money paid for advantages already consumed, and which will yield no direct permanent income to the State; at least the same sum must continue to be paid every year: whereas money laid out on works, such as canals and tanks, creates sources of future Revenue. To treat productive Public Works executed by Government, as no longer property, because not in the form of rupees, is preposterous. There should, therefore, be a Department of Public Works which should keep a complete and distinct set of accounts of its own, and every thing spent by it should be divided under two heads, 1st, current expenditure on superintendence and necessary repairs, (which should afterwards be entered in the general accounts of the State as part of its current expenditure); and, second, new works including improvements. A stock account should be kept to balance against Capital invested, and means should be taken to obtain a tolerable estimate of the actual total returns of all new works, so far as they could be ascertained and stated. And if at the end of five years it appeared from these accounts, that twenty millions had been spent, and that there were twenty millions worth of Public Works on hand, yield-

ing in various ways, upon a reasonable estimate, ten millions a year, we must not, therefore, conclude that we are twenty millions poorer than we were, and weary ourselves to discover how to get rid of this twenty millions of debt, but rather comfort ourselves with the thought that we are paying with one hand £800,000 a year, and receiving with the other ten millions sterling. I am afraid people will say, "We don't require a "book to tell us such things as these; they are not discoveries." But what is to be done? as these things, which every body knows, never appear either in the minds or the deeds of the Government of India, there seems no alternative but to bring them forward once more. Notwithstanding the general neglect of Public Works, there is even now something considerable in the shape of property, yielding abundant returns to balance the debt we have incurred. Perhaps in the new irrigation works in Tanjore and Rajahmundry, and in works elsewhere in this Presidency, such as the Madras Western road, the Grand Trunk road, the North-West canals and other works, a stock account to the amount of two millions sterling or more, might be made up: and all this is *bonâ fide* property, just as much as the rupees that were spent on the works: or rather, much more so. Perhaps on an average, these two millions yield two millions annual profit to the community; and if so, they are equivalent to a Capital of fifty millions sterling, or fifty crores of rupees, nearly equal to the whole Indian debt. If these things are taken into consideration, as most undoubtedly they ought to be, they will give a totally new aspect to the state of Indian Finance.

It must be remembered that we are now dreadfully in arrears as to all measures tending to the improvement of the country; that we have to make up for fifty or sixty years of utter neglect of almost everything that it was incumbent upon an English and a Christian Government to do. Proportional prompt decision and effort is, therefore, called for, and most richly will India repay those who will labour for her. It must not be supposed because we see her outwardly in nearly the same state of brutal ignorance, abject bondage to caste, and degraded poverty as when we conquered her, that therefore no change has taken place. A secret undermining of old ideas and principles has been going on both directly and indirectly, from the new circumstances in which she has been placed, which assuredly has greatly prepared the way for her to benefit by the means that may be used by an honest, active, energetic, open Government. The moment such a Government is substituted for the present system, assuredly India will show a change like life from the dead. What a glorious change for England, what a stimulating though awful trust! How incalculably important is the present crisis! If England should ever awake to her responsibilities and honours, and declare that the present system shall no longer be endured, that instruction shall be given both in the knowledge of the true God and in matters connected with the present life, and that things essential both to mental and physi-

cal improvement shall henceforth be provided for the millions whom it has pleased God, in His providence, to place under our charge; then she will assuredly see 150 millions of people rapidly emerging from their present state, and becoming her glory and strength.

Who can bear to go through India and see its degraded state, and think what it ought to be after fifty or 100 years of the rule of the most free, enlightened, and powerful of all the nations of the earth; the only nation that is not effectually hampered in her own progress either by a false religion, or by some form of slavery? What more can be necessary than to bring the influence of such a nation fairly to bear on the millions of India? What can have hitherto prevented the marks of her rule being seen in the instruction, liberation, and the enriching of the people of India, except a system which has in effect warded off that influence, by *Asiaticising* first, all who (called Englishmen) were to have a hand in her nursing. Nothing is more certain as a general rule, than that all men in a great measure, and most men entirely, lose their individuality, and become an intrinsic part of that system with which they are mixed up. A Kentucky slave-trader would have as great an abhorrence of slavery as any of us if he had been in England from the age of eighteen to fifty; and any old Indian would be as much startled as any other Englishman, at the unchanged state of an Indian village or district notwithstanding our rule, if he had never before been out of England. He would probably say, "What! are there no Chris-"tians here? Do you not instruct them in any thing? Have you no "roads or any other communications? What in the world do you do? "I do not see a single mark of an Englishman having been in the coun-"try." But as a part of this system, all this appears to the Anglo-Indian the most natural thing in the world. "It is the way we do in India. "In England of course we are quite different beings. There we never "dream of discussing the mode of collecting the Land Revenue, but we "take part in a thousand plans for improving our own and our neigh-"bour's condition."

A new race of beings, a new system, a new set of ideas are required. Publicity, light and air, the immediate exposure of every public document connected with the ordinary business of Government, for free discussion by young as well as old, all these things are essential to such a change as India requires. And who cannot but hope that in the providence of God we are on the eve of a new start for India; and that the present discussions will lead to breaking up for ever the old decrepid system, and give rise to a fresh, healthy and vigorous one, worthy of our religion and our nation?

CHAPTER V.

THE PRESENT ENORMOUS COST OF TRANSIT AS A BURDEN ON THE COUNTRY.

Area of India with extent of Communication at present.

TAKING the whole area of India (including all between the ocean, the Himalayas and Afghanistan) at a million and a quarter square miles, we shall find, that to open out this tract, with main lines of communications fifty miles apart, would require about 50,000 miles of main road; besides all the minor roads, which, if placed five miles apart, would be 500,000 miles in length. We may now frame a very rough estimate of the actual extent of communications with the cost of transit by them.

	Miles.	Rate per ton per mile.
1st.—The sea navigation from the mouth of the Indus to that of the Ganges	3,500	5 to $8\frac{1}{2}$ pice ($\frac{5}{8}d.$ to $1\frac{1}{16}d.$)
2nd.—River navigation. .	2,000	4 pice or $\frac{1}{2}d.$
3rd.—Complete roads . . .	2,000	1 anna or $1\frac{1}{2}d.$
4th.—Imperfectly made roads, perhaps.	10,000	2 annas or $3d.$
5th.—Unimproved tracks.	...	3 annas or $4\frac{1}{2}d.$
Total ...	17,500	miles.

Before we proceed further, however, we must examine these prices, to see what proportion they bear to those of England or America. The actual value of one anna is about $1\frac{1}{2}d.$ or 3 cents, reckoning the rupee at two shillings; but we must allow first for the difference in the value of money. A pound of rice in India costs about three pice or $\frac{3}{8}d.$, and the same quantity of the flour of other grains about two pice or $\frac{1}{4}d.$ Taking the cost of flour in England at $1\frac{1}{2}d.$ a pound, the value of money as shown by the value of food, may be taken at six times as great in India as in England; and if we try by the cost of labour, taking it in its simplest form, we find that a cubic yard of earth may be dug and carried to a bank ten yards off, for about $\frac{3}{4}d.$ on an average in India against about $6d.$ in England. The same with other kinds of labour; and it will

be near enough for our present purpose, to take the value of money in India at six times what it is in England, on an average, though over a great extent of country like India, it is as much as eight to one. It is probably fully ten times greater than in America, calculating from the rate of labour; but not more than perhaps five times by the cost of food, labour being better paid in America than either in India or England. We may, therefore, reckon the Indian rates of transit as equivalent in England, to

6*d.*	per ton	per mile	by sea.
$3\frac{1}{2}$*d.*	do.	do.	by river.
9*d.*	do.	do.	by good roads.
1*s.* 6*d.*	do.	do.	by imperfect roads.
2*s.* $7\frac{1}{2}$*d.*	do.	do.	on unimproved tracks.

Is not this alone quite sufficient, without a word more, to account for the impoverished and backward state of India? The average of all the traffic of India cannot be less than one shilling per ton per mile, allowing for the difference in the value of money, while in England the average cost to transit may probably be taken at $1\frac{1}{2}$*d.*, or one-eighth of that of India; it must indeed certainly be at least eight times as great in India as in England, taking it only mile for mile.

The following are some of the English rates:—

Liverpool to Manchester	3*d.*	a mile	per ton,	Railway.
London to Birmingham	$\frac{4}{5}$*d.*	do.	do.	Canal.
Liverpool to Birmingham	$1\frac{3}{4}$*d.*	do.	do.	Railway.

What would be the diminution of traffic in England if the cost were suddenly increased eightfold? probably nine-tenths of it would be stopped.* But this calculation still does not give by any means a complete view of the case; we must compare also the comparative distances that goods must be carried in the two countries. In India the extreme distance that goods must be carried to reach the port is 1,200 miles; in England it is about sixty miles. The average distance that exports and imports are carried in India may be 250 miles; whilst in England it cannot exceed forty. We may safely allow, therefore, that in general, goods are carried six times as far in India from the place of production to that of consumption or of export, as they are in England; so that combining this with the cost, there is in India thirty-six times as heavy a charge upon transit as in England. But there is yet a third consideration; that the average value of the commodities moved in India is far below that of those transported in England; by far the greater proportion of articles moved in India being coarse goods, raw produce and such things; while in England a very large proportion consists of manufactured goods and other valuable articles. If, for instance, we take a ton of Berar cotton at

* In America the cost of traffic by railway may be taken at $1\frac{1}{2}$*d.*, and that of conveyance by the river navigation at $\frac{1}{3}$*d.* per ton per mile, the average being considerably below that of England.

the price actually paid to the cultivator, the charge of transit compared with its value will be as follows:—

Cost of 1 ton of cotton in Berar	Rs. 120—£12.
Do. of carriage 350 miles to Bombay at 3 annas ($4\frac{1}{2}d.$) per mile	„ 66—£6 12*s.*, or 55 per cent.
Do. of do. at Liverpool at $4\frac{1}{2}d.$ a lb. . .	£40.
Carriage of do. by Railway to Manchester, 30 miles, at 3*d*	£0 7*s.* 6*d.*, or nearly 1 per cent.

and in its manufactured state, the cost of transit would bear a still smaller proportion to its value.

Again, we may take a ton of sugar brought from the Upper Provinces to Calcutta.

Cost where produced ....,............	Rs. 120—£12.
Do. of transit to the Coast by river........	„ 20—£2, or 17 per cent.
Value of do. in London...............	£40.
Cost of conveying 50 miles to place of consumption	£0 8*s.*, or 1 per cent.

If we take the *average* value of goods conveyed in England, and compare it with that of India, we shall find that the percentage is even higher than the highest of these.* We shall, therefore, probably be safe in concluding, that the cost of transit in India is equal to an *ad valorem* tax on the goods conveyed, fully fifty times that of England. We cannot form a correct judgment of the burthen to India of this rate of transit as compared with that of other countries, without taking all these things into consideration. What would England be with such an incubus upon it, as this tremendous transit tax in India!

The mere comparison of the rates per ton per mile, therefore, must give a totally false idea of the state of the case, unless we take into consideration the following points:—

1st, The relative value of money;
2nd, The distance carried;
3rd, The value of goods;
4th, The time and risk.

Until these points are understood and considered, there can be no hope of any serious effort being made to relieve India from a burthen, compared with which the whole of the taxes received by Government are of little importance. How is it possible that India, notwithstanding

* And to all these we must still add the extra cost in time and risk; for, supposing that cotton is two months travelling to Bombay, the interest at 12 per cent. per annum would be 2 per cent., and the insurance also could not be less than 2 per cent.

its cheap labour, extent of rich land, powerful sun, and copious monsoons, can contend in the markets of the world with other nations while weighed down by such a load? There can be no mistake on the point of its immense advantages in all other respects, compared with other countries.

We may now try to form an estimate of the amount of this tax, as actually paid in money; and although the data for this are very imperfect, yet we may easily satisfy ourselves that it cannot be less than a certain sum. We may take first some well-established instances of the cost of traffic.

It has been estimated that the amount of inland traffic at Calcutta is 2,000,000 tons per annum. If we take the average traffic between the N. W. Provinces and that port at 1,200,000 tons, and the cost at twenty-five rupees (£2 10*s.*) a ton, (four pice ($\frac{1}{2}$*d.*) a ton per mile for 1,200 miles), the total cost on this line of transit will be 300 lacks (three millions sterling) a year for goods only. The rate is stated much higher than this in the Railway pamphlets, but there are evident mistakes in them. The total cost, including interest and insurance, is there calculated at nine pice (1$\frac{1}{8}$*d.*) a ton per mile; which would give a total of 648 lacks (£6,480,000), besides the sums paid by passengers. If we allow for the river expenses 500 lacks (five millions sterling), including every thing, I think we shall be under the mark, and, supposing these two millions of tons to be brought on an average fifty miles by land to the river, at three annas (4$\frac{1}{2}$*d.*) per ton per mile, it will add 180 lacks (£1,800,000) to the above, making a total of 680 lacks, or nearly seven millions sterling; a sum equal to one-fourth of the amount of the whole Revenue of India expended on this one single line of transit.

As regards the Coasting trade, we have an instance in the case of the Paumbam channel. The traffic through it is at present 148,000 tons, including empty vessels; perhaps in all 120,000 tons of freight, allowing for loaded vessels carrying more than their tonnage. This is mostly carried between Ceylon or the Western Coast and Tanjore or Madras, at about ten rupees (£1) a ton, and therefore costs twelve lacks (£120,000), besides interest and insurance; perhaps twenty lacks (£200,000) in all; on a distance of about 500 miles. The traffic on the Western Coast is far greater than this, and the cost of the traffic along the whole 3,500 miles of Coast round the Peninsula, cannot be less than 200 lacks, or two millions sterling.

Of the traffic by land in this Presidency, we have an instance in the great Western road from Madras. The traffic on the first 125 miles is about 100,000 tons a year, at one and a quarter anna (nearly 2*d.*) per ton per mile; or in all ten lacks (£100,000), besides passengers, and interest and insurance.

Allowing then 900 lacks (nine millions sterling) for the Ganges and the

Coast traffic alone, besides all the vast land traffic of the interior, we surely cannot over-estimate the sum actually paid in India for transit, by taking it at 1,500 lacks, or fifteen millions sterling; and hence, if the average cost of transit could be reduced to one-fifth of what it is at present, the country would be relieved of a direct tax of twelve millions sterling, equal to a diminution of the present taxes by one-half.

But this is only a small part of the effect of opening the country generally, and giving it cheap, safe and expeditious transit. The present great loss is, *not* in what is paid for goods carried, but in what is lost in things that are not carried at all. We have a strong proof of the immense traffic there would be, if the cost of conveyance were diminished, in the case of the Paumbam Channel; where, in consequence of the reduction of freight to one-third of what it was before, and the diminution of time and risk, the trade has actually increased ninefold, though the cotton that used to pass through that channel is now shipped at the ports of Tinnevelly. What is the traffic of England now, compared with what it was before there were either canals, railways, or even turnpike roads? It must certainly since then have increased a hundredfold, and I have no doubt that it would increase in India in something like the same degree, particularly considering that the proportion of cost of transit to the value of the goods is (as shown above) so much greater in India than it ever was in England, on account of the much greater distances the goods must be carried, as well as their inferior value. There can be no doubt, that a transit charge of 50 per cent. on the value of goods must be a much greater check to traffic than one of five; and that if it were reduced from 50 to 10 per cent., the increase of traffic would be much greater than if reduced from five to one. It is, in fact, absolutely beyond calculation to what extent the traffic would increase, if goods could be moved 100 miles a day at one pie ($\frac{1}{8}d.$) per ton per mile, instead of ten miles a day at one and a half anna ($2\frac{1}{4}d.$); and I have no doubt, that by due improvement of the rivers, a very large proportion of the traffic would be conveyed at one pie ($\frac{1}{8}d.$) per ton per mile.

As yet, I have noticed only the loss in money from the expensive transit, or absolute non-transit of goods; but who can estimate the effect on the country of the hinderance to personal intercourse resulting from the present state of things? What would be the state of England, if not only the cost and time of passenger transit were increased tenfold, but if also there were throughout the country no such things as relays of animals posted for conveyances; so that, if a man wanted to travel he must go by daily stages only, as long as the same animal could go, and the journey from London to Liverpool were thus to take a man, who could afford to ride, seven days; the same time that such a distance takes in India. In this country, if a man wants to go a moderate journey, such as 300 miles, he must be fifteen to thirty days about it, besides

all the inconvenience of having to take people with him to cook his food, or cook it himself wherever he stops. This country is not even in the state England was before there were railroads or turnpike roads; because even then, there were relays of animals throughout the country. How much intercourse would there now be in England, and how would business be carried on, if a merchant of London, who wanted to see a manufacturer in Birmingham, must be from home a week; or, having to transact business with a Yorkshire clothier, must be absent a fortnight? It is impossible for those who have not witnessed it to conceive the amount of disadvantage under which India labours in this respect.

Notwithstanding these difficulties, however, the passenger intercourse is even now surprisingly great, though I am aware that the general idea on the subject of travelling in India is quite the contrary; the question having in fact been raised, whether there would be at first any considerable number of passengers on the railroads.

The following are some of the ascertained numbers :—

On the high road from Negapatam to Tanjore, at a point 20 miles from a city, in 1837	1,200 adults a day.
On the bridge over the Colleroon, 3 miles from the Town of Trichinopoly	19,000 per day.
From Calcutta towards the Upper Provinces	1,500 ,,
On one of the main roads, 11 miles from Madras	3,000 ,,

From these instances, and from experience in the country, there is no doubt that if there were *cheap* transit, even at the rate of 100 miles a day, there would be an immense passenger traffic on all the main lines. Between Negapatam and Trichinopoly, for instance, there can be no doubt that the present passenger traffic would be quadrupled; so that there would be 5,000 travellers a day. On the great Western road from Madras, also, as soon as the railway is extended to 150 or 200 miles, there will, no doubt, provided travellers can be conveyed at a rate proportional to that in England, suppose at one pie or $\frac{1}{8}d.$ per mile, be several thousands of passengers a day.

Of the beneficial effects of free intercourse on the country, especially in weakening the system of caste, (the great curse of India), who can fully judge? But of this at least we may be certain, that with such means of intercourse, the country will in ten years make more real progress in every thing that is desirable, than in one hundred years without them.

Returning, however, to that part of the subject which can be shown in figures, we see that we have to deal at the very least with a matter of fifteen millions sterling a year in actual payments; and if we only allow as much more as lost in things either not produced, or wasted, because

the cost of transit prevents their having a market, it will show an annual loss to the country of thirty millions sterling, or much more than the whole amount of the taxes. Could we relieve the country from five-sixths of this, it would be at least equivalent to abolishing all taxes; and it would, in fact, be incalculably more beneficial, because there would be all the gain of the immense stimulus thus given to industry and exertion. Of the existing hinderances to production, from high cost of transit, we may judge from the following: If a ton of any produce be carried 200 miles at three annas ($4\frac{1}{2}d.$) a mile, or a total cost of thirty-seven and a half rupees (£3 15*s.*) for the whole distance, a trade of the extent of 100 tons would cost Rs. 3,750 (£375) a month, or Rs. 45,000 (£4,500) a year. So that if at the present high rate of transit, an article be not worth moving; by reducing the cost of transit two-thirds, that article might yet afford a merchant a profit of £3,000 a year. Again, the cost of carriage of cotton from the place of production to the shipping ports, is often eight pounds a ton; ten times as much as would afford a merchant's profit on the goods.

Seeing, therefore, that articles which cannot now be carried, because there would be no profit on them, might, with cheap transit, be brought to afford a profit ten times as great as would be sufficient to create a trade in them, it becomes easy to comprehend how, on every diminution of cost of transit, the amount of traffic increases so surprisingly. Again, if one part of the country be particularly favourable for the growth of some article of produce, the extension of its cultivation will depend, not only on the cost of transit, but also on the cheapness with which food and other necessaries of life can be brought to those employed in producing that article. At present, the cultivators of a good cotton district are compelled to grow their own food on the spot, because the great cost of transit utterly precludes the conveyance of such a bulky thing as grain, from any distance; whereas, if the cost of conveyance were reduced, the whole of the land, peculiarly favorable for cotton, might be given up to that culture, and food for the cultivators brought from other parts where cotton could not be grown so profitably. At present it costs $\frac{1}{3}d.$ to convey one pound of rice 180 miles, thus doubling its original cost; so that the carriage of food for one man for a year (720 lbs.) for that distance, would cost ten rupees (£1), or nearly one rupee (2 shillings) a month, about half a man's wages;* whereas, if the transit cost were reduced to one-fifth, or to one-twentieth, (as it might be where there is water-carriage), the same quantity of rice (720 lbs.) might be brought that distance for one anna ($1\frac{1}{2}d.$) a month; and thus the soil and climate best suited to a certain article of produce might be wholly given up to its cultivation. How immense would the traffic thus become! Perhaps, for instance, the principal part of the agricultural population of Berar

* Which are about two rupees monthly for an ordinary agricultural labourer in his own village.

would be employed in growing cotton, while their food would be grown in the irrigated lands of the Delta of the Godavery. If only two millions of people were so provided with food, there would be a traffic up the Godavery, in food alone, of 700,000 tons a year.

Not a ton of any thing, except timber, is now carried by the Godavery, though it is navigable for at least six months in the year. A comparatively moderate outlay would make it navigable throughout the year; and, if it were navigated, goods could be carried between the Coast and Berar for from one to five rupees (2 to 10 shillings) a ton, whereas the present difference in the value of rice, cotton, salt and wheat, in these two places, is on an average about Rs. 100 (£10) a ton. The Berar people now grow their own rice at four times the price they could get it for from Rajahmundry by the Godavery, and also pay four times as much for salt; while they have no sale at all for their wheat, and comparatively little for their cotton, because of the cost of transit to the Coast. Under other different circumstances, Berar could supply Manchester with cotton and wheat at 25 per cent. less than is paid to America for the same things; and if thus provided with a market for its staples, and relieved from the high cost of food and salt, it could afford to purchase the manufactures of Manchester, Birmingham, Yorkshire, and all parts of England. In this way it is easy to see what immense traffic there may be in this country, when the cost of transit is greatly reduced; and how incorrect must be all calculations based entirely on the present amount: also, the extent of traffic there may be on a proposed line of communication. It is not only that the traffic may be doubled or trebled; it may easily be increased ten or fiftyfold: in fact, a reduction of cost of transit may produce any extent of traffic. A reduction of five rupees (10 shillings) a ton, may lead to the creation of a trade in some vast and bulky staple of which not a ton was moved before; and consequently give rise to a sale of goods to the extent of twenty times the amount saved in transit. The opening of the Godavery may, on the most moderate calculations, raise the sale of cotton and wheat grown in Berar, to the amount of a million sterling, and that of rice and salt produced in Rajahmundry, to half that amount; and give rise to a demand for English manufactured goods to the value of another half million. At present, only comparatively valuable things are moved, and bulky things of small value, such as articles of food, building materials, manure, &c., are scarcely moved at all; so that the population of one district are compelled to spend their labour and occupy their land in the cultivation of articles of food which are grown far more cheaply in other parts, whilst their own land would much better repay the cultivation of the particular articles best suited to its soil and climate; the towns are polluted by an accumulation of filth, for want of which the fields are barren; and the towns are without good building materials, while the country, where they are of no value, is full of them.

It is most essential to keep these points in view in planning improved communications; otherwise, we shall be deterred from attempting them, under the false idea, that the interest of the money will be a much greater charge upon the carriage than it would be in reality. Thus, if the cost of a railway be Rs. 30,000 (£3,000) a mile, and the present amount of traffic be 100,000 tons a year, and the actual cost of working the road two pice or $\frac{1}{4}d.$ a ton per mile, the following calculation might be made of the rate at which goods must be charged, to give 10 per cent. interest.

10 per cent. on Rs. 30,000 (£3,000) = Rs. 3,000 (£300).

Which, divided among 100,000 tons, would be .... 6 pice or $\frac{3}{4}d.$ per ton.

Add cost of transit..................... 2 ,, or $\frac{1}{4}d.$,,

Total... 8 ,, or $1d.$,,

about one-half or two-thirds of what it would be on a good common road; which would, perhaps, more than quadruple the present traffic. But if a great reduction of cost took place, so that the traffic were increased fivefold, the calculation would then be

10 per cent. on Rs. 30,000 (£3,000) = Rs. 3,000 (£300).

Which, divided by half million tons, would give per ton.................. $1\frac{1}{5}$ pice or $\frac{6}{10}$ farthing.

Add for cost of transit per ton ... $1\frac{2}{5}$,, or $\frac{7}{10}$,,

Total... $2\frac{3}{5}$,, or $1\frac{3}{10}$,,

or one-fifth of the present cost on good common road, which would, probably, at the very least, increase the traffic fivefold, and necessitate the addition of a second line of rails as soon as the first was in operation. In the second calculation I allow a lower cost of transit, because that of management and other things would be distributed over a greater surface. In England the actual cost of working the railways is two pice or $\frac{1}{4}d.$ per ton per mile; and it will certainly be less in this country, at the same velocity.

Let us again take the example of the Calcutta Railway; supposing it to cost Rs. 1,20,000 (£12,000) a mile, that 10 per cent. profit is to be allowed for, and that it were capable of conveying the whole of the present traffic.

10 per cent. on Rs. 1,20,000 = Rs. 12,000 (£1,200).

Divided over present traffic of two million tons .... $1\frac{1}{5}$ pice or $\frac{6}{10}$ of a farthing.

Add for cost of transit .... $1\frac{2}{5}$,, or $\frac{7}{10}$ of a ,,

Total.... $2\frac{3}{5}$,, or $1\frac{3}{10}$ of a ,,

which is perhaps three-fourths of the present cost by the river, allowing for interest and insurance in the present mode of transit. This would, no doubt, cause a large increase of traffic; but if the interest were paid entirely by passengers, (which it may probably be), the transit of goods would cost only one and two-fifths of a pice ($\frac{7}{10}$ of a farthing) per mile, about one-fourth of the present rate; which would, probably, double the existing traffic; though it could not of course have by any means so great an effect on the traffic as a change from a common road to a railroad, where the railway would take off one anna ($1\frac{1}{2}d.$) a ton from the cost, whereas in the above case it might take off only two pice ($\frac{1}{4}d.$). It must be observed, that the above calculation is made only on the ground assumed by the railway projectors, *viz.*, that a double line of railway could carry two million tons a year besides passengers: it is not intended to imply that such a thing is possible.

The case will be still clearer if we take an imperfect road and substitute for it a good steam canal, which could be executed, in a great part of this Presidency, at a cost of Rs. 15,000 (£1,500) a mile, the interest of which would be paid by the passengers, thus,

10 per cent. on Rs. 15,000 = Rs. 1,500 (£150),

which, with 1,000 passengers a day, would only be one pice or $\frac{1}{8}d.$ per mile, for each person. The charge on goods would then be about half a pice or $\frac{1}{16}d.$ per ton per mile for a considerable distance; the same rate at which goods are now carried on the Mississipi, and one-thirtieth of the present cost of transit on the ordinary roads. At this rate almost anything could be moved, and it will be curious to see the effect of it upon an important line of communication. In investigating the subject of a proposed line of traffic in a country so entirely without communications, the question is, *not* "what is the present traffic," but "what are the comparative prices of any great staples at different points on the line." In India, it will often happen that the main traffic on a new line of cheap transit is one entirely created by the new work.

The most important point proved by the above considerations of the present cost of transit, is the absolute necessity of a very great reduction in it: since no trifling reduction will at all answer the purpose, and much less will the plan of the railway projectors, to convey at a rate as high, or higher than the present, answer any useful purpose. The present rate is utterly destructive and ruinous; so much so, that the country cannot thrive under anything approaching to it. The above statement of the proportion of the cost of transit to the value of the principal goods moved, shows that no small reduction will effectually relieve the country; and much less would an increase of speed without any reduction of price, be beneficial. No greater mistake can be made than to suppose that an increase of speed is the main thing required. If the grand railways effect nothing more than what their advocates state, they will do nothing

to any purpose. In the pamphlets and reports about the Bengal and Bombay Railroads, they talk of a charge of from eight pice to two annas (1*d.* to 3*d.*) per ton per mile. If this be all that the most perfect railways can do for India, and if there were no other means by which something could be accomplished, our case would be hopeless indeed. If India is to advance in any thing, *it must have cheap transit, really cheap transit, at one-tenth or one-twentieth part of the present rates.* In planning the great railways, the real points to be attended to have been entirely lost sight of; and this first one especially. When the projectors talk of charging 1*d.* to 3*d.* per ton per mile, they do not consider the fact, that a good common road will carry at $1\frac{1}{2}$*d.*; and that the imperfect unimproved natural water transit where it exists, costs only $\frac{1}{2}$*d.* In the Bengal Reports they make out that the river transit costs nine pice ($1\frac{1}{8}$*d.*) per ton; but this is more than double the real cost. One of the fallacies in the calculation is, that interest is charged on all goods as being worth £40 a ton; whereas the great bulk of the traffic is, either grain value £3 a ton, salt £3, sugar £12 or £15, saltpetre £18, and iron £10; so that probably not one-twentieth part of the goods is worth £40 a ton.

What we have now to do, is to discover means whereby the cost of transit may be materially reduced, so as to give a real relief to the country, and enable it to compete with other countries. Till this is accomplished, nothing is done. All our immense advantages of soil and climate, and cheapness and abundance of labour, are lost; or, at least, the greater part of them. This is well shown in the state of the Berar cotton trade, in regard to which it is stated by those who have the best means of knowing, that cotton is actually grown and sold on the spot at four-fifths of an anna (or $1\frac{1}{4}$*d.*) a lb. To this about $\frac{3}{4}$*d.* (half an anna) is added in bringing it into the great cotton marts of the district where it is cultivated; fully 1*d.* or two-thirds of an anna more in conveying it to Bombay, and still more in taking it to Calcutta. Another penny is added to the cost in bringing it into the English markets; and thus it arrives at Manchester, at a cost that only puts it on a par with American cotton, grown by slave-labour, at an enormous expense. At least one anna ($1\frac{1}{2}$*d.*) per lb. could be taken off by improving the communications, and throwing open that part of the country where so favourable a climate and soil are found for the growth of cotton. It is not merely that for want of cheap transit a direct charge of a penny or more is added to the cost of the cotton; but for the same reason, food, salt, &c., are three or four times the price they need otherwise be. This is only one of many ways that the price of cotton is indirectly augmented. At present the purchasing of the cotton from the cultivators is entirely in the hands of the ignorant, short-sighted, oppressive Native merchants. The Natives begin to be very sensible of the advantage that it would be to deal directly with Europeans; but nothing can deliver them from the present system, but an open com-

munication with the ports, giving Europeans free access to the districts, and gradually removing the absurd fancies that mercantile men have about living in the interior of the Peninsula, as if they could not do it without great risk to their lives. The extent to which the cost of the produce of India may thus in different ways be reduced in foreign markets, is beyond calculation; for the mere reduction of the charge of transit is by no means the total amount of the diminution of cost that may be effected.

But it must specially be borne in mind, that where the distances are so great, the value of produce so small, and the present cost of carriage per mile so enormous, it is not a trifling reduction that will do. Till this point is understood, nothing effective will be done towards the real improvement of India. I am satisfied, as I have stated, that the money now paid for transit, and lost for want of it in India, is in fact equal to the whole amount of taxation.

It is not surprising that this essential fundamental point of the necessity of a great diminution of the cost of traffic should have been treated as a matter of no consequence by the Engineers and others concerned in projecting the great railways; for their views were naturally contracted to this comparatively insignificant question, *viz.*, "Will such a railway pay to the shareholders?" but that this really important point should have been so lost sight of by the public and the authorities, is indeed surprising! The question for the Government to consider is, "What does the country really require in the "way of transit, and by what means can the greatest advantage be "obtained for the whole community?" The interest of the shareholders, and that of the community in a line of rail, may be diametrically opposed. If a railway on an important line be constructed on so expensive a plan, as to require a high rate of charge to enable it to pay a good interest, an irreparable evil will have been done; and the whole power of an influential body (influential and powerful, just in proportion to the amount of capital expended) will be brought to bear on that line; *not* in order to secure cheap transit, but to prevent cheap transit ever being obtained on it.

If the proprietors of the Bengal railway, for instance, charge (as proposed in the pamphlets) 1*d.* per ton per mile, there seems no hope that that line will be ever favoured with a cheaper communication than it has at present by the river. Though other parts of the country might be favoured with this essential advantage, probably no power could be found sufficient to prevent this, the most important line by far in all India, from being sealed up against the use of any means by which cheap carriage could be obtained. Of the various means that could be used for this purpose, and there are several, (for I am certain that on this line goods could be carried at the rate of one pie ($\frac{1}{8}d.$) per ton per mile, as

well as on the Mississipi), there would be no probability of any being adopted, so long as the owners of the four millions sterling invested in the railway, felt that the whole of their property depended upon their successfully resisting all improvements.

Happily, however, the matter is very far indeed from standing as it is stated in the railway pamphlets: for even with all its present imperfections, the river transit will provide for the conveyance of goods at a much lower rate than 1*d.* per ton per mile. But as to the railway accomplishing the main object, that of materially reducing the charge, I see no prospect of it; so that whatever may be effected elsewhere, the probability is at present, that no material improvement will take place in the rates to be charged on this most important line, which ought to be the line of greatest traffic in India.

CHAPTER VI.

ON THE IMPROVEMENT OF THE LARGE RIVERS FOR NAVIGATION.

How to lighten the burden of high Transit.

WHAT means can be found then to relieve the country from the intolerable burden of cost of transit, supposing it to amount at this moment to fifteen millions a year in actual payments, besides the loss of as much more in things which will not bear the present charges, and cannot, therefore, be moved at all? Is the case really hopeless? Have we indeed no alternative but to lay out a lack of rupees (£200,000) a mile, or 200 millions sterling, on the whole 20,000 miles of main line required, and then to go on paying for ever nearly as much as we do now?

Hopeless indeed would the state of India be, if this were really the case; but nothing can be farther from the fact. On almost every line in India, the cost can be reduced to one-fifth or one-tenth of what is at present contemplated by the great railways.

We have first the natural water-communications, and the question is, what may be done by means of them? The following paper (written some time ago) may be properly introduced here, as showing more fully what extraordinary openings we have in India for improving the country by means of the rivers:—

"By no means the least important part of the present project (the Godavery Delta works) is, its helping to open the navigation of the Godavery. That part of the river between the hills and the sea was in the dry season exceedingly shallow in places; sometimes only a few inches deep. The anicut greatly diminishes the hinderance to the navigation of the river. Below the anicut there will be a constant deep channel to tidal-water. Through the hills the water is of a great depth, and the first serious obstacle occurs at Badrachellum, 130 miles from the Coast. From thence (300 miles) to Woonie on the Wurda, which is eighty miles from Nagpore, there are (by Captain Fenwick's account), six obstructions from rock, all which might be removed or diminished at a moderate expense. That gentleman, when employed in connection with

Messrs. Palmer's houses, repeatedly navigated the river with timber and loaded boats, and cut through one rocky obstruction, at a cost of only Rs. 400 (£40). In connection with the Delta works, it seems of the highest importance to open this most valuable line of communication through a country, a great part of which has hitherto been almost beyond the reach of commercial enterprise. By Captain Fenwick's account, there seems no doubt, that the cotton of Berar, and many other things, might be conveyed to a portby water, at one-tenth of what is now paid for land carriage to Bombay.

"It is highly probable that the Kistnah also may be navigated to a great extent; but I have no positive information on this point.

"In the present great question of the cotton supply, there seems to be scarcely any point more worth investigation than this opening of the fine cotton countries of Nagpore to the Coast. No doubt the cultivation would extend rapidly along the whole line of the Godavery. It seems now to be generally acknowledged, that Berar is naturally the most suitable climate and soil for cotton for the English market, and, therefore, we should make it our grand effort to open a cheap line of communication with it; and it is certain, that no other line can possibly compare with that of the Godavery for bringing cotton to the Coast. Captain Fenwick tells me, that during the three years Palmer's house brought their capital to bear on this tract, the cultivation of cotton, and the general welfare of the people, increased surprisingly. There is thus a line of 500 miles of the cheapest communication, leading into the very heart of the country, to be had almost for nothing: for even if five lacks (£50,000) were spent in improving it, it would still only cost Rs. 1,000 (£100) a mile.

"In the paper on the Berar cotton by Mr. Ashburner, read before the Asiatic Society in 1837, the importance of this subject is shown on the very best authority. He states that this cotton can be cultivated at thirty rupees (£3) per Bombay candy, (less than 1*d*. a lb.), and that the only obstacle to its unlimited production is the cost of transport; that it is sent to Bombay on bullocks at twenty-four rupees (£2 4*s*.) a candy, (less than three farthings a lb.), taking seventy days on the journey; and that large quantities which cannot reach Bombay before the monsoon, are consequently liable to be damaged or destroyed. That there was at that time a traffic of 20,000 tons a year in salt and Berar cotton; and that if a good bandy road were made, there would be a saving of sixteen lacks (£160,000) a year. He then goes on to say, 'It may be as well, however, to show the 'productive powers of the country more clearly, to instance the increase 'which has lately taken place in the amount of cotton exported from 'Bombay. From 1828 to 1835 the exports averaged 178,000 bales a 'year, and remained nearly stationary. But the high prices of the latter 'year led to more extensive cultivation, and, notwithstanding numerous 'obstacles to production, the Presidency of Bombay last year produced

'and exported no less than 290,000 bales of cotton, being an increase 'of 112,000 bales within the year. Some portion of this increase, no 'doubt, is attributable to an unusually good season, but by far the largest 'share arose, as the reports of the Revenue Collectors show, from exten- 'sion of cultivation alone.' Here is a specimen of what India is capable of doing under favourable circumstances; and there can be no question but that the cotton trade would, with good roads to the interior, go on increasing as rapidly as during the year mentioned by Mr. Ashburner: for the stimulus to cultivation would then be as great from decreased expenses, as it has lately been from increased prices.

" 'Thus, with proper management, we might reasonably expect to see 'the exports of the country in this staple alone, swelling at the rate of '100,000 bales per annum, and amounting, probably at no distant period, 'to a million of bales. And what would be the consequence in other 'respects, besides benefiting the Revenue, and improving the condition 'of the people of India? Such a trade would give employment to 'a vast amount of British shipping (400,000 tons), at the same time 'that it created a greater demand for the manufactures of the mother- 'country.'

" Now, if this cotton, instead of being carried (as Mr. Ashburner proposes) by a bandy road, were conveyed down the Godavery at the rate at which goods are carried on the Mississipi, *viz.*, one pie ($\frac{1}{8}d.$) per ton per mile, or about two and a half rupees (5 shillings) per ton for the whole distance, there would be a saving of seventy rupees (£7) a ton, or of twenty-one lacks (£210,000) on the whole annual traffic of 20,000 tons, besides saving the interest, insurance, waste, &c.

" Think of a great portion of this cotton being at present carried from the banks of the Godavery (500 miles from the sea) by land 500 miles to Mirzapoor, to be embarked on the Ganges at a point 550 miles from Calcutta. But the important point in Mr. Ashburner's paper is his testimony to the astonishing increase of production, consequent on an increase of price; showing clearly the grand fact, that every thing within that tract of country is in a complete state of preparation, and that nothing is wanting but a relief in the cost of transit, to make cultivation increase to almost any extent. We have in Berar, climate and soil specially adapted for producing a good marketable cotton for England; people ready to cultivate it, cattle, latent enterprise only requiring to be developed, and all requisites except communications. This line of cheap river transit would probably cause a reduction of full $1\frac{1}{2}d.$ a lb. in the price of cotton; five times as much as would be sufficient to give a material stimulus to the trade.

" But the comparative prices in this central tract with those on the Coast, will strikingly illustrate the effect of communications, and show

what the state of a country must continue to be, notwithstanding every other natural advantage, if not opened out by cheap transit.

	COST PER TON.		Difference.	Percentage of the difference.
	In Berar.	At Coringa.		
	Rs.	Rs.	Rs.	
Rice	124	45	79	175
Cotton	186*	325	139	75
Wheat	31	66	35	113
Salt	105	30	70	200

"From this comparison some idea may be formed of the extent to which property would be created, by opening a communication on this line of 500 miles. At the rate of one pie ($\frac{1}{8}d.$) per ton per mile by the river, the cost of transport would be only two and a quarter rupees (4*s.* 6*d.*) a ton for the water carriage; and, allowing on an average a land carriage of fifty miles by railway at four pice ($\frac{1}{2}d.$) per ton per mile, and ten miles by common roads at three annas ($4\frac{1}{2}d.$), the total cost of conveying a ton of cotton to and from the port, would be about as follows:—

500 miles of river transit at one pie ($\frac{1}{8}d.$) ..	$2\frac{1}{4}$	Rs.	(5 shillings)
50 of railway at four pice ($\frac{1}{2}d.$)	1	„	(2 „)
10 of common road at three annas ($4\frac{1}{2}d.$) .	2	„	(4 „)
Total....	$5\frac{1}{4}$	„	(11 shillings)

"There would then be a creation of property as below, by the reduction in the cost of transport.

A ton of Rice	74	Rs.	(£ 7 8*s.*)
„ Cotton	134	„	(£13 8*s.*)
„ Wheat	30	„	(£ 3 0*s.*)
„ Salt	70	„	(£ 7 0*s.*)

"If the Rajahmundry rice and salt were thus placed fully within reach of the inhabitants of these districts, and the wheat and cotton of Berar again placed within reach of the manufacturers of England, it is impossible to say what the traffic on this line might become. The wheat especially might be cheaply made into flour by the abundant water-power of Rajahmundry, and conveyed to England by hundreds of thousands of tons. As wheat, it could certainly be landed in England at 4*s.* a bushel; and as flour, at a still cheaper proportional rate.

* Including the local merchant's profit.

"The saving or production of property by opening the Godavery, might thus be something near this :—

200,000	tons	Rice at Rs.	74 (£ 7 8*s.*) .	148 lacks	(£ 1,480,000)
100,000	,,	Cotton at ,,	134 (£13 8*s.*) . .	144 ,,	(£ 1,440,000)
200,000	,,	Wheat at ,,	30 (£3)	60 ,,	(£ 600,000)
90,000	,,	Salt at ,,	70 (£7)	63 ,,	(£ 630,000)
			Total.	415 ,,	(£4,150,000)

The outlay to produce this trade might be as below :—

For river improvements	10 lacks	(£100,000)
For 200 miles of railway at Rs. 10,000 (£1,000) per mile.	20 ,,	(£200,000)
Total . . .	30 ,,	(£300,000)

"Of course the traffic might extend far beyond this; for the tendency of the whole thing would be for Rajahmundry to supply a large proportion of Berar with food, while that district in its turn could feed an immense population in England, and also supply them with materials for industry. It is thus that almost any amount of property may be produced, by an outlay on communications, however small.

"How immense might be the effect of thus supplying Manchester at once with cheap cotton; and how powerfully would it certainly affect the trade of that city! Who can possibly estimate the effect of thus giving to that great manufacturing city such an immense additional advantage in its competition with other countries? In our race with America, this lowering of the cost of flour and cotton would produce results far beyond any possible calculation.

"If the gain by the reduction of cost of these products were equally divided between the two parties, (the buyer and seller), it would make the following difference of prices :—

Cotton in Manchester	4*d.* per lb. instead of 4½*d.*		
Wheat in ,, ...	4*s.* 9*d.* a bushel instead of 5*s.* 6*d.*		
Rice in Berar	85 Rs. a ton	,,	Rs. 124
Salt in ,, ...	67½ ,,	,,	,, 105

"It is well known, however, that the real division of profits is much more in favour of the purchaser than the seller, in such cases, when trade is open; but a very small addition of profit to the people, in a country already full of population and with an unlimited extent of suitable soil, would be a sufficient stimulus to an immensely extended production, and this is expressly stated by Mr. Ashburner, who is perfectly acquainted

with the state of things in Berar. The increase of produce would be so great, as very soon to ensure a supply to the consumer, without any excessive profit to the producer. Nay more, if the people of Berar were supplied with rice, salt and many other things, at a much lower cost than they now pay, they could afford to supply cotton at a price actually lower than at present, and yet with an increased profit to themselves.

"But with respect to the effects of such a communication, whoever may divide the profit, the facts are certain, that the people of Berar are at present paying Rs. 124 (£12 8*s.*) per ton for rice grown on the spot, whilst, with easy communications, they might supply themselves with it from Rajahmundry for thirty rupees (£3); that they are paying ninety rupees (£9) per ton for salt, while they might get it for thirty-five rupees (£3 10*s.*); and that the Manchester manufacturers are paying £40 a ton for Berar cotton, while it could be supplied to them for £30; and £10 a ton for wheat, while it could be supplied to them for £6.

"The things that I have enumerated above, are only a portion of the various products which would be interchanged. Besides numerous smaller articles of food, such as chillies, cocoanuts, onions, &c., produced so very cheaply in the irrigated lands of the Delta of the Godavery, (but which are scarce and dear in Berar), who can doubt, but that, if these countries instead of being in the paralysed state they now are, were carrying on a most extensive and profitable trade with other parts of the world, they would immediately demand vast quantities of English manufactured goods, and thus again in another way produce an immense effect on England?

"There seems thus to be no reason, why the Godavery may not become the line of trade of a million tons a year, when once the pent-up treasures of its basin effect a breach in the barriers, by which it has hitherto been closed.

"Respecting the nature of the navigation of the Godavery, I should state the following points:—

"The fall of the river from near Chandah to the sea, averages about one and a quarter feet per mile; but this is not quite equally distributed. Captain Fenwick states, that there are six rocky barriers in its bed, which could be removed by blasting, at no great expense. The fall of one and a quarter feet per mile is very moderate for steam navigation; with a depth of 10 feet it would give a current of about three miles an hour. In Mr. Ellet's remarkable report on the Mississipi, he states that the Alleghany has been navigated as high as where the fall is four and one-third feet per mile; and the Ohio at Pittsburgh, where steamers are innumerable, has a fall of about one and a half feet a mile. He says, 'By 'observing the descent of the Alleghany from Franklin to Pittsburgh, 'we may conclude, that rivers, of which the fall does not exceed two feet 'per mile, are navigable for steam boats, unless there be great irregu-

'larity in the distribution of that fall. In the event of such irregularity 'existing, rivers having an average descent not exceeding two feet per 'mile, if well supplied with water, must afford exceedingly good navi-'gation between the rapids, which must be very remote and easily 'overcome.'

"We learn also from these tables, that a descent of nearly four feet per mile is not incompatible with the existence of steam-boat navigation, if the supply of water be well maintained; for a steam-boat has ascended the Alleghany as far as Olean Point, overcoming, in places, a slope of nearly five feet per mile. In this report Mr. Ellet shows how easily the summer navigation of the Ohio might be improved by storing water in tanks, to be discharged when the river is low; and this is perfectly applicable to the Godavery. For instance, an additional depth of one foot, at a ford 200 yards broad, where the current was two miles an hour, could be obtained by the supply of five and half millions of cubic yards per day, or 330 millions for two months; and as this quantity could probably be stored for one and half lacks of rupees (£15,000) (perhaps much less), a sum equivalent to not more than Rs. 300 (£30) a mile on the whole length of the navigation, or perhaps a two-hundredth part of the cost of a complete railroad, some idea may be formed from this, of the facility with which an additional depth of water might be given, if necessary.

"We reckon that we can easily find situations in the Carnâtic, where water can be stored for one rupee per 1,000 cubic yards; and I have reason to believe, that the country in Berar is much more favourable for storing water than here, because the country there has a less fall, and consequently a bund of a certain height will retain a greater breadth of water. Captain Fenwick talks of the Godavery being now navigable for eight months in the year, meaning, as I believe, that there will be not less than three or four feet of water during that time. Supposing the quantity of water flowing to be 500,000 cubic yards per hour at the most in those eight months, and that it diminishes during the other four to 100,000 cubic yards, it would, on an average, require an additional 200,000 cubic yards an hour for four months, to keep the river in that state which Captain Fenwick calls navigable. The amount required for this purpose would then be 200,000 × 24 hours × 122 days = 600 million cubic yards; and I have no doubt this quantity could be stored for three lacks of rupees (£300,000) which, divided over 500 miles of navigation, would be equal to Rs. 600 (£60) a mile. The great advantage of this mode of improving the navigation is, that no works would be required in the bed of the river demanding such skill in construction, and care and attention in management, or involving such risk of injury, as to stop the navigation even for a time. No doubt some trifling work, such as blasting rock, &c., might be performed in the bed of the river, which would greatly improve the

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navigation also; but this would be simple and of trifling cost, and by these means I have no doubt that a depth of at least three feet could be retained in the river throughout the year at a fiftieth part of the cost of a double railway, and that goods could be conveyed by it at one-fifth of the cost of railway transit; and this with a speed of 150 miles a day up the river, and 200 miles down the stream, a speed that would certainly answer all present purposes. Some years ago, when some reports on the navigation of the Severn were sent me by a Civil Engineer at home, I suggested to him this mode of effecting his object, the Welch Lakes affording him peculiar advantages for storing water; but I have not heard whether anything was done about it. Had this plan been adopted in the Ganges, it is literally incalculable what the advantages of it would have been. The cost of ten miles of railway would have given a fine navigation of probably three or four feet, and doubtless have reduced the cost of transit in the dry season by one-half. A reduction of two pice ($\frac{1}{4}d.$) a ton per mile, on one and half million tons carried 1,000 miles, would have been a total saving of 150 lacks ($1\frac{1}{2}$ millions sterling) a year, besides the saving of time and risk; and it would have made a total change in the steam navigation of the river.

"Of course the water, besides being used for the navigation of the Godavery, would, on its arrival at the anicut, be distributed for irrigation, for which it would be worth forty times what it cost to store it; so that, if necessary, no part of its cost need be charged to the navigation. But the river is even in its present state available for navigation with vessels of small draft, for eight months in the year at least; and it must be remembered, that the canals in Canada and New York, which have produced such prodigious results, are only open six or seven months in the year. The only reasons why the Godavery is not at present used are, want of enterprise in the Natives, and the interferences of petty Zemindars on its banks; and Government can remove the latter in a moment, and give the necessary stimulus to get over the former, by themselves setting the example of navigating it.

"This matter of the upper Godavery navigation is worthy of a far more particular and careful report than would be suitable in this paper; and I would only mention, as favouring highly the advisableness of undertaking such a work, the astonishing success that has attended the Paumbam works. When I was sent there in 1822, the whole amount of traffic was 17,000 tons a year, though the whole of the cotton from Tinnevelly was then carried through the channel to Madras; whereas now, the traffic is sometimes more than that in one month (though the cotton is almost all shipped at once from Tuticorin); and the annual traffic is 168,000 tons, or tenfold the former quantity. Such has been the effect of deepening that passage from four and half to ten and half feet. Such an instance is an unanswerable proof of the fact that traffic

is waiting for communications, and not that communications have to wait for the traffic, as some still suppose. How strangely the state of the question of communications in India is misapprehended, has been singularly shown in this case, as before stated, by the perfect indifference with which the opening of the Godavery was treated by the Government of India:

"1st. The Company's Government, who are so deeply interested in everything that concerns the whole of India, would certainly gain a Revenue of many lacks by the increased demand for salt.

"2nd. The Government of Nagpore and Hyderabad would undoubtedly feel, in numerous ways, the effect of such an increased demand for their produce.

"3rd. The manufacturers at home are most deeply interested in this, which, I feel confident, is the best opening yet discovered for obtaining for them an increased supply of cotton on the one hand, and an increased market for all English-manufactured goods on the other.

"4th. The anti-slavery body are nearly concerned in it, since nothing, so far as yet appears, would so much tend to weaken the slavery system of the United States, the enormous profit now realised from their partial monopoly of the cotton trade being one of the chief incentives to it.*

"5th. The shipping interests are concerned in it. An addition of 50,000 tons of cotton alone a year would give employment to 150 large ships; more than would be required to bring the same quantity from America.

"Further, I would remark, that though undoubtedly the efforts that have been made to introduce the American varieties of cotton into India are most commendable; yet, it seems certain now, that had a tenth part of the same money and pains been expended on opening out this magnificent cotton country by cheap communications, immensely superior results would have been obtained. Let the reader refer to Mr. Bonynge's "Future Wealth of America," the production of a practical planter; and though we may not admire the blustering style in which it is written, we cannot but admit its force; and we have the means, in some instances, of testing the accuracy of the statistics. Its general object is to show, that cotton cultivation in America, though it has contributed so powerfully in times past to its wealth, is now irrecoverably on the decline, and must be abandoned for the cultivation of tea, coffee, indigo, and other plants. From the statistics furnished, it appears that cotton has for twelve years declined in price 30 per cent. yearly; rice during nine years, in quantity and quality, 15 per cent.; tobacco, in quantity the last five years, $2\frac{2}{3}$ per cent.; that bread stuffs are returning to the same amount

* "Well, said St. Clare, suppose that something should bring down the price of cotton, once and for ever, and make the whole slave property a drug in the market."—*Uncle Tom's Cabin.*

of exports that they were prior to the failure of the potato crop in Europe; and that sugar cultivation is not advancing. With the present prices of labour in America, there is no possibility of extending the cultivation of these articles; and, except tobacco, it is feared that they will all greatly decline. Cotton cannot be cultivated in America under $5\frac{1}{2}$ cents per lb.; whereas India can produce it and land it in Liverpool at 7 cents per lb. After a fourteen years' residence (as a planter) in the East, and after a tour through South Carolina and Georgia, Mr. Bonynge is constrained to admit, that India has every means of producing as good cotton, and much cheaper than America; and he further asserts, that had it not been for the potato failure, and the timely aid of California, America could never have borne the decay of her principal staple for the last ten years.

"What then ought the Godavery Delta to become, as the outlet of the whole trade of the basin of the Godavery containing 130,000 square miles, when it supplies that immense region with rice, salt, tobacco, sugar, chillies, and numerous other things, which can only be produced in inland districts at four times the price? Is it too much to expect, that an immense mercantile city will spring up on the coast, near the harbour of Coringa, from which millions of tons of wheat, cotton, oil seeds, sugar, rice, tobacco, hemp, &c., will annually be exported, and into which English-manufactured articles to an immense amount will be imported for the use of the twelve millions of people who will thus be so enriched, as to become extensive consumers of such things? I cannot see anything to prevent this if the country continues to be blessed with peace; unless, which is scarcely conceivable, it be insanely determined not to take the first step towards opening the navigation of the Godavery. Probably little more than the first step is required; for in such a case, when once the trade begins, it must go on; nothing can stop it."

Upon the whole, there seems to be no possible means of transit that can surpass steam communication by water in point of cheapness; and that too at a speed which will certainly abundantly answer all our present purposes. The rivers that may be easily improved are, the Ganges, Jumna, Gogra, Chumbul, Gunduck, Soane, Bhugirutty, Mahanuddee, Nerbudda, Godavery, Kistnah, Wurdah, Munjera; and, no doubt, several minor rivers.

Perhaps, in all there may be found 5,000 miles of river navigation, which may be made thoroughly convenient. All rivers, which have not a greater fall than two feet a mile, will be quite available. Such a fall, with a depth of twenty feet, will give a current of about five and half miles an hour, and with a depth of five feet, of three miles an hour; and it must be remembered that the number of days in the year in which Indian rivers are nearly full, is very small indeed, since for eight or nine months in the year they are very low. If on these lines, which, it must be parti-

cularly observed, will bear by far the greater portion of all the traffic of India, transit can be effected at one pie or one-eighth of a penny per ton per mile, our main object will be already gained. We know that on the Ganges there is now a traffic of upwards of a million tons a year; and if this river were greatly improved by keeping the quantity of water always up to a certain height, there can be no question but that the amount of traffic would be prodigiously increased; probably at least doubled, and more likely increased fourfold. Perhaps the greatest improvement in the way of communication that could be made in all India in comparison of its cost, would be by the construction of a weir across the Ganges below the head of the Bhugirutty, to turn the whole stream into that river in the dry season. This weir would keep the Bhugirutty navigable throughout the year, and give rise to an immense traffic. The weir across the Godavery (twelve feet high with a clear water way of 4,000 yards) has cost eight and a half lacks (£85,000) including six sets of sluices, three locks, &c. If the Ganges weir, six feet high, cost five lacks (£50,000) the interest, Rs. 25,000 (£2,500) would be equivalent to a charge of three and half pice (nearly $\frac{1}{2}d.$) per ton on the present traffic; or, taking the distance from the head of the Bhugirutty to Calcutta at 150 miles, one-tenth pie per ton per mile, besides the benefit to travellers. The Godavery would undoubtedly convey the whole traffic of the basin of that river, which cannot at present be less than 150,000 tons a year, and would increase in a far greater proportion than that on the Ganges; for this obvious reason, that there is at present no water carriage on the former. All goods are now carried at about three annas ($4\frac{1}{2}d.$) a ton per mile; and if the cost were reduced to one pie ($\frac{1}{8}d.$) it is impossible to say what the traffic would be, but there can be little doubt that it would be increased five or sixfold, or to a million tons per annum. If, as before suggested, two millions of people, employed in cotton cultivation, were fed from the irrigated Delta at the mouth of the river, that alone would call for a traffic of 700,000 tons a year. In the same way, the Indus, the Nerbudda, and the Kistnah, would undoubtedly convey the whole trade of their basins; though what the probable amount of it would be, I have no means of judging.

We should thus at once provide for the really cheap conveyance of probably half of the whole traffic of the country; and if the cost of transit by the Ganges were thus reduced to half of what it now is, with a similar reduction on the Indus, and if the change of water for land carriage, on the lines of the other rivers named, were to reduce the cost there from three annas ($4\frac{1}{2}d.$) a ton per mile to two pice ($\frac{1}{4}d.$), there would be a saving to the country of many millions sterling.

The following calculation, though not given even as an approximation to the actual saving, will at least give some idea of the amount of direct saving.

Saving on 1,200,000 tons conveyed 1,200 miles on the Ganges, at two pice ($\frac{1}{4}d.$) per ton per mile.	$1\frac{1}{2}$ million sterling.
Do. on 500,000 tons carried 450 miles by the Godavery, at three annas ($4\frac{1}{2}d.$)	4 do. do.
Do. on 50,000 tons carried 500 miles on the Indus, at two pice ($\frac{1}{4}d.$)	$0\frac{1}{40}$ do. do.
Do. on 50,000 tons carried 400 miles on the Kistnah, at two and half annas ($3\frac{3}{4}d.$)	$0\frac{1}{3}$ do. do.
Total	6 millions sterling,

besides the amount saved on the Nerbudda, Soane, &c. But besides this, there would be a profit on all the additional traffic on the Ganges, which we may safely reckon at as much more; so that a saving of ten millions might thus be effected, entirely exclusive of the saving on the transit of passengers, and of all those immense effects (which cannot be calculated in money) of such improved lines of transit.

The following extract from the Professional Papers of the Corps of Royal Engineers, on the Halifax and Quebec Railway, contains many things bearing upon the point under consideration:—

In the United States they are well aware of the increased value which internal improvements and communications give to property of every kind.

In those countries works have been undertaken for that object alone, not for the mere return which the work—whether railway, road, or canal—would make of itself.

The indebtedness of the several States has been incurred almost entirely in making great internal improvements; and in the boldness and unhesitating way in which they have incurred debts and responsibilities, for the purpose of developing their resources, may be seen the secret of their unrivalled prosperity.

The State is in debt, but its citizens have been enriched beyond all proportion.

Most unfavourable comparisons are made by travellers who visit the British Provinces and the United States; and some have gone so far as to state, that travelling along, where the boundary is a mere conventional line, they could at once tell whether they were in the States or not.

On the one side the State Governments become shareholders to a large amount in great public works, lead the way, and do not hesitate to incur debt, for making what has been termed "war upon the wilderness;" employment is given, and by the time the improvement is completed, property has been created, and the employed become proprietors.

On the other side the Provincial Governments do not take the initiative in the same manner, and hence in the settlements, and in the provinces generally, may be seen this marked difference in the progress of people who are identically the same in every respect.

Until the British Provinces boldly imitate the policy of the States in this regard, and make "war upon the wilderness," their progress will continue to present the same unfavourable contrast.*

The creative or productive power of canals, railways, &c., may be traced in the history and progress of the State of New York.

The Erie Canal was commenced in 1817, and completed in 1825, at a cost of 7,143,789 dollars, or £1,400,000 sterling. In 1817 the value of real and personal property in the city of New York was, from official documents, estimated at £16,436,000 sterling. In 1825 it was estimated at £21,075,000 sterling. In 1820 the population of the State was £1,372,000 and in 1830 the population of the State was £1,918,000.

The canal was found so inadequate to the traffic, that between the years 1825 and 1835, a farther sum of £2,700,000 was to be expended in enlarging it.†

Making the total cost to that date £4,100,000 sterling.

It has been seen that in the city of New York

In 1817	the official value of real and personal property was			£16,436,000
In 1835	do.	do.	do.	£45,567,000

Being an increase of two and three-quarter times in eighteen years.

For the State of New York

In 1817	the official value of real and personal property was			£63,368,000
In 1835	do.	do.	do.	£110,120,000

Or an increase of nearly £47,000,000 sterling in the value of property; attributed chiefly, if not entirely, to the formation of the canals.

In 1836, the amount conveyed to tide-water by the canal was 697,357 tons.

And on the 1st of July of that year there had accumulated in the hands of the Commissioners an amount sufficient to extinguish the whole of the outstanding debt incurred in its construction.

The net receipts from all the State canals, after deducting the expenses of collection and superintendence for the year 1847, was £449,270. Villages, towns, and cities have sprung up along its course.

The population of the State, which was

In 1810	959,949
Was in 1845	2,604,495

In 1846 the value of real and personal property was estimated at £128,500,000.

It will be seen from the above, therefore, that in addition to the wealth created for individuals, the canals produce a large annual revenue to the State.

The following extracts from the financial affairs and statistics of some of the States may be quoted in illustration of this part of the subject:—

1847.

MASSACHUSETTS.

	Dollars.
Total indebtedness of the State, 1st January 1847	999,654
Credit of the State, lent to railroads	5,049,555
Total liabilities of the State...	6,049,209

* In one remarkable case however, our Engineers have taught the people of the States a lesson; the magnificent Steam Canals on the line of the St. Lawrence have effectually drawn the traffic of the upper Mississipi valley from the Erie Canal fitted up for animal draft.—(Note by Ed.)

† It is to be again enlarged.

As security for the redemption of the scrip lent to railroads, the commonwealth hold a mortgage on all the roads, and also 3,000 shares in the Norwich and Worcester, and 1,000 in the Andover and Haverhill.

PENNSYLVANIA.

	Dollars.
Public property, canals and railroads, at original cost..........	28,657,402

MARYLAND.

Receipts from Baltimore and Ohio railroad........................	42,402
Do. from Canal Companies..	11,550

NORTH CAROLINA.

Debt of the State, on account of Railroad Companies.........	1,110,000

OHIO.

Debt contracted for the sole purpose of the construction of Public Works within the State..		19,246,000
Canals, 820 miles in length, cost..		15,122,503
Net receipts in 1846, after paying repairs and expenses........		408,916
In 1810 the population of this State was..............	45,865	
In 1820 do. do.	581,434	
In 1840 do. do.	1,519,467	

Or tripled nearly in 20 years, during the progress of her canals.

MICHIGAN.

Debt on 30th November 1845..	4,394,510

Total length of railroads finished and belonging to the State, 222 miles.

This State was authorized to raise a loan of 5,000,000 dollars for internal improvements.

For the same purpose, Congress granted to the State 500,000 acres of land.

In 1840 the population was..................................	212,267
In 1845	304,278

Or an increase of 50 per cent. nearly in five years.

INDIANA.

	Dollars.
In January 1847, the public debt was..................................	14,394,940

By the terms of the Act adjusting this debt, it is to be equally divided between the State and the Wabash and Erie Canal. Of this canal, which is to be 458 miles long, 374 miles are in Indiana; 174 of this portion are finished, and in operation. There remain 200 miles to be completed, upon which part, about 1,200,000 dollars have been expended by the State. It is estimated to cost the farther sum of 2,000,000 dollars to complete the entire canal. To cover this amount the State is to transfer to trustees 963,126 acres of land adjoining to or in the neighbourhood of the canal.

The population of this State in 1811 was	24,520
Do. do. 1830	343,031
Do. do. 1840	685,086

Or doubled in ten years.

ILLINOIS.

			Dollars.
1847	Total internal improvement debt...........................		8,165,081
	Total canal debt..		6,009,187
			14,174,268
	The population in 1830 was	157,455	
	Do. 1840 was	476,183	

Or tripled in ten years.

The sales of the public lands during one year (1845)

In the United States amounted to	1,843,527	acres,
Producing..	2.470,298	dollars,

Or an average of 5*s.* 7*d.* sterling per acre.

But to show the effect produced by a canal or railway passing through property, the following extract may be quoted from the Report of a Board of Directors of the New York and Erie Railroad Company in February 1844:—

"The Board find that they have omitted one description of property, which has heretofore been considered of great value, but the right to most of which has been lost to the Company, by failure to complete the road within a certain period; the most valuable of which consisted of 50,000 acres of wild land in Cattaraguas country, near Lake Erie, and one-fourth part of the village of Dunkirk."

"An offer in writing was made in 1837 by responsible parties to take these donations, and pay further the sum of 400,000 dollars, provided certain portions of the railroad were completed within a specified time."

That is, about eight dollars, or 33*s.* 4*d.* sterling per acre.

In Michigan 461,000 acres were granted by Congress for the endowment of a University. These lands were selected, in sections, from the most valuable of the State. The price of these was at one time twenty dollars or £4 6*s.* 8*d.* sterling per acre, but became lower afterwards; 17,142 acres, the quantity sold up to 30th November 1845, brought £2 9*s.* per acre; 69,000 acres, devoted to Schools, were sold per £1 7*s.* per acre.

Such then are some of the results of making "war upon the wilderness."*

Upon the whole, the opening and improvement of the rivers of India would provide perhaps the cheapest possible carriage for half the traffic of India, with a fair speed; and produce a saving in money of at least ten millions sterling, and more likely to a much greater amount. Reckoning that so large a sum as Rs. 2,000 (£200) a mile were expended

* In fact, the sole reason why England has hitherto bought its millions of bushels of wheat, and hundred thousand tons of cotton from America, is, because both the States and Canada have, at an enormous expense, formed water communications from the valley of the Mississipi, and made a proper use of their rivers, which we in India have not done, excepting in the case of the Ganges, which has only been used because the Natives used it before we came. The United States spent eight millions sterling on the Erie Canal, without which (or the St. Lawrence navigation) not a bushel of wheat could have gone from the upper Mississipi to England; while if we had spent £70,000 on the Godavery, we could have supplied all England with both wheat and cotton.

upon these improvements, (chiefly in storing water as above described), the total expense for every 5,000 miles would be 100 lacks, or one million sterling. What other means of improving the country could possibly be compared with this? Excepting in irrigation, no opening for the employment of capital equal to this could possibly be found; nor one that would produce one-quarter of these results. If four-fifths of this outlay be employed in storing water, it would give for the Ganges, 1,200 miles at Rs. 2,000 (£200) per mile, total twenty-four lacks (£240,000); which, at 2,000 cubic yards stored per rupee, would supply 4,800 millions of cubic yards, or an average of twenty-four millions a day for 200 days; and this would be equal to a gradually increasing supply from nothing, to forty-eight millions per day, or twenty-six millions per hour, when the river was at its lowest. That is, an average of twenty-four millions of cubic yards per day for the whole 200 days, would provide a supply of forty-eight millions when the river was at the lowest if it fell gradually: equivalent to raising the water three feet where it was 600 yards broad, with a current of one and half miles an hour. But so utterly insignificant is such an outlay compared with the object to be attained, that if necessary, five times as much water as is here calculated, could be stored. If this water were divided between different reservoirs, placed in the upper parts of the basins of the Ganges and its several feeders, the Jumna, Chumbul, &c., the total length of navigation improved would be perhaps 2,400 miles, and the cost would then be Rs. 1,000 (£100) a mile; or there would be an annual charge of fifty rupees (£5) in interest, which, divided between 800,000 tons average traffic, would form a charge of one-eightieth pie per ton per mile. Let this only be compared with the effects of Rs. 100,000 spent on a mile of railway!

CHAPTER VII.

NAVIGABLE CANALS.

Good Steam Canals better in some respects than Rivers.

When the rivers are thus turned to account, the next question is, whether on any lines canals could not be constructed, so as to give the cheapest possible lines of transit? Whenever good steam canals can be obtained, they will of course be preferable in some respects to rivers; the principal reason being that they can be worked day and night, so as to give a speed of 300 miles a day with fast steamers. For a chiefly down trade, as that of India is on all the lines of the rivers, there will of course be an advantage in the current, if not too great, which still-water canals would not have; but still the transit on steam canals would be exceedingly cheap; certainly not exceeding half pie ($\frac{1}{16}d.$) per ton per mile. On the channels in Rajahmundry in their present incomplete state, three pice ($\frac{3}{8}d.$) a ton per mile is paid for short trips of ten or twenty miles; and the rate would certainly be very much lower for long voyages of 100 to 500 miles, in canals completed in every way, and with suitable boats; for the boats now in use on the Rajahmundry channels are those formerly used for the river navigation, and by no means the most suitable ones for canals. The cargo boats used on the Godavery works cost, including the aid of two small steam tugs, half anna ($\frac{3}{4}d.$) per ton per day for all expenses; which, supposing they pass over twenty miles a day, would give one-third pie ($\frac{1}{24}d.$) per ton per mile per day; and these boats carry twice the crew they would if working only on canals. For the carriage of the coarsest goods, such as building materials, &c., for which a very low speed would be sufficient, the cost of transit would be still lower.

It must be observed also, that the transit on Government canals would be greatly more extensive in this country than in England, for two reasons :—

1st. On private canals, it is not for the interest of the owners that an extremely low rate of transit should be charged; the fear of crowding the canal and consuming water prevents their reducing the tolls beyond a certain point; whereas, it would be the interest of Government to

encourage the utmost possible use of the canals, and it would be advisable to let all goods go free, rather than in the least diminish the traffic. When the Government have executed such a work, it is for their interest that the greatest possible use be made of it, and it would probably be best not to levy any toll; as there can be no doubt that the indirect returns from it, in increase of taxes from land and other things already taxed, would much more than yield to Government the interest for money so expended.

2nd. Canals made expressly for steam navigation would of course be used for many purposes, for which canals in England often cannot be used. With capacious locks, so made as to be rapidly filled and emptied, and the canal itself both broad and deep, they will be admirable passenger lines. The locks on the Rajahmundry channel will admit vessels of more than 100 tons; and if ultimately kept six feet deep, as intended, they will admit iron vessels of 140 tons, and thus allow of the highest speed. (Steamers on the Hudson draw only four feet, with a speed of eighteen or twenty miles an hour.) But passenger traffic at slow speed would be immense, as travellers could be carried at an expense much below that of walking. The twenty-horse-power steamer on the Godavery worked at low speed, (six miles an hour), costs two annas (3*d.*) per mile, and, including wear and tear, &c., four annas (6*d.*); but when tugging with 100 passengers, would cost less per mile, as she would go faster, and the charge would thus be only half pie ($\frac{1}{16}$*d.*) per man per mile, even if there were no first class passengers on board, to pay a larger share of the expenses. Such canals could undoubtedly be navigated in this country at eight miles an hour, and at a charge of one rupee (2 shillings) per 400 miles, for the lowest class of passengers. How great the number of passengers would be on such a line, is curiously shown in the case of the Pulicat Canal, on which—though it forms at present no part of any great line of communication, but merely extends thirty or forty miles from Madras, to a part of the country where there are no great towns—there are more than 100 travellers a day paying about one pie ($\frac{1}{8}$*d.*) per mile, though they actually travel slower than a man walks. Were this line extended to the Northward so as to form part of the main northern approach to Madras by land, connecting that city with Hyderabad, Nagpore, and the Northern Circars, there could not be less than 1,000 passengers a day, and there would probably be several thousands, with steamers moving at a moderate speed, and charging from one-third of an anna ($\frac{1}{2}$*d.*) down to half pie ($\frac{1}{16}$*d.*) per head per mile.

As for the lines on which canals might be cut with advantage, and would upon the whole be the most suitable kind of works, we have first, the Ganges Canal, already well advanced. Of the value of this work, as a means of irrigation, I need not here speak particularly; it will no doubt be a work of incalculable value in that respect, though the effects of such

works in that part of the country, seem to be unaccountably small as compared with those of similar works in the Madras Presidency; and though accompanied with the terrible drawback which attends irrigation in all moderately hot countries, *viz.*, fever. As a work of communication too, there can be no question, but that it will also be of incalculable value. Such a magnificent canal, extending nearly in a straight line 450 miles, (besides its branches of 400 miles), passing through a most populous and fertile country, and terminating at the point where the Ganges, even in its present state, is navigable for steamers all the year round, will, if I mistake not, be the most important work yet executed or commenced in India. If it cost (as now estimated) 160 lacks (£1,600,000) for 850 miles, (including the heavy works of the first fifteen miles), its cost will be under Rs. 20,000 (£2,000) a mile, for a canal fifty yards broad and ten feet deep at its head; and gradually diminishing to its lower end, though still a good navigation. Such a work in this country at such a price, even if intended merely for navigation, would surely be one of the greatest bargains ever made. If 8 per cent. covers interest and management, the annual cost would be Rs. 1,600 (£160) a year per mile, amounting, on a trade of one million tons a year, to a charge of only one-third pie ($\frac{1}{24}d.$) per ton per mile; and if the interest, &c., were paid entirely by passengers, (as it might very well be), it would provide that vast tract of country with a transit for goods at a rate not exceeding half pie ($\frac{1}{16}d.$) per ton per mile, free from all risks, and navigable day and night, at any speed that each kind of freight might require. Having also a current in the direction of the trade, the cost of transit will probably be the lowest that has ever yet been seen in internal transit; if not even lower than sea transit, which, for long voyages, does not now exceed half pie ($\frac{1}{16}d.$) per ton per land mile; (£3 a ton from India to England, 12,000 land miles measured on the shortest route). The importance of this canal at the present moment is beyond calculation; it will show in the strongest light the difference between steam canal communication and grand railways: for if interest and insurance are charged to irrigation, (as they may well be in this case), it will be very nearly equivalent to the total abolition of the cost of transit, as the actual expense will be so small as scarcely to be felt in any articles of produce. Indeed, the contrast between this and the Bengal railway will be very curious; the one costing only Rs. 20,000 (£2,000) a mile, providing for the interest, &c., by its use for irrigation, and conveying goods at certainly half pie ($\frac{1}{16}d.$) per ton per mile, and first class passengers at perhaps two pice ($\frac{1}{4}d.$); and the other, costing Rs. 1,00,000 or Rs. 1,20,000 (£10,000 or £12,000) a mile, and charging (according to the reports) eight pice (1*d.*) per ton, and probably at least four pice ($\frac{1}{2}d.$). It is true, that while the canal is worked at 300 miles a day for passengers, the railway may be worked at 700;

but the advantage of speed in this country is at present utterly insignificant in comparison with that of reducing the *cost* of transit.

Supposing 500,000 tons of goods carried 450 miles by canal and railway, at the above rates, the account would stand thus: 500,000 tons by railway 450 miles,

at four pice ($\frac{1}{2}d.$) per ton per mile	47 lacks	(£470,000)
Interest 5 per cent. on 450 miles of rail at one and a quarter lacks per mile...	28 ,,	(£280,000)
Total cost by railway ...	75 ,,	(£750,000)
On the other hand:		
500,000 tons by canal, 450 miles, at half pie ($\frac{1}{16}d.$) per ton per mile	6 ,,	(£ 60,000)
Annual saving, by canal	69 lacks	(£690,000)

or half million sterling.

But this calculation does not include the benefits from increased traffic; for the cost of transit on the canal being one-eighth of that by railway, the traffic by the former might be ten times that on the latter.

Had the canal been continued on to Calcutta, and at the same cost, *viz.* Rs. 20,000 (£2,000) a mile, the valley of the Ganges would have had the greatest advantage in the way of transit that could be desired, or indeed that could be found in the world; and probably at the cheapest rate.

We have already, however, 850 miles of a noble canal in a considerable state of forwardness; and there cannot be a doubt, that even now, it ought to be continued on to Calcutta, giving 500 miles more. We have not yet seen what a double railroad is capable of conveying, but it certainly cannot accommodate a trade of two million tons a year, (about 7,000 tons a day), unless the passenger trains be restricted to the same speed as goods; and if so, the advantages of very high speed (for which so much has been sacrificed) will be lost, and the railway would even in this respect have no advantage over a canal; *so that the railway does not in reality lessen the necessity for a canal.* It is still generally, but erroneously, supposed, that railways and canals are directly antagonistic works, though the contrary has been fully proved both in England and America. For instance, far from the railway between New York and Buffaloe having superseded the canal on the same line, twenty millions of dollars have, within a few years, been expended on the enlargement of the latter; and it now carries the great mass of traffic, although closed by frost for five months in the year. Even if the railway could accommodate 7,000 tons a day, probably as much more would be conveyed by a canal, if worked at half pie ($\frac{1}{16}d.$) per ton per mile. Between Manchester and Liverpool, where there is a much smaller traffic than there

would be here, there are no less than four lines of communication, all in full use; and two millions of tons a year are carried by two of the canals, while only 180,000 are carried by the railway.

There is yet another point showing how narrow a view has been taken of the subject. Even with respect to this one particular line, the question, "How can this actual amount of traffic be best provided for?"—the proper question for the Government and the public—has never yet been asked. There can be no doubt, I think, that the great mass of the traffic will remain untouched by the railway; it will continue to come down the river just as it does now, and there is little probability that the railway will convey more than 2,000 tons a day at the utmost.

The necessity of providing for the remainder of this traffic, brings us to the question, which would be best; to form a canal? or, as before suggested, to throw water into the river? I think there can be no doubt that the canal will be in every way superior to the river, however much the latter may be improved; and the cost of transit, including interest, will still be much less on the canal than on the river. But, on the other hand, there is this strong argument in favour of first improving the river, *viz.*, that it can be done at one-tenth the cost of a canal, and probably in one-tenth of the time; and this brings us to the second fundamental point in the general enquiry about communications in India, viz., *the time in which extensive lines can be opened throughout India.* In my opinion, the grand evil arising out of this unfortunate mania for English railways in India, has been, that in following the illusion of *high speed of transit*, we have been effectually turned off from the great object of all, viz., *speed in executing communications.* No man can be more sensible than myself of the advantages of speed of transit, which in England was a vital point; but it is utterly insignificant in this country, in comparison with the importance of quickly laying open the whole country. In this respect then, high speed railways are in fact what the Australians called their bullock waggons "*crawling nuisances;*" crawling across the country at the rate of ten miles a year, while we ought to be getting over 5,000 miles in that time. It is exactly like a catamaran man spending a gold mohur on a bracelet, but leaving his ten square inches of clothing as it was; or like a starving beggar spending on an Ice, what would have given him bread for a month. What will be the results, even in respect of speed, of this mode of proceeding? that at the end of ten years we shall be able to travel at thirty or forty miles an hour from Calcutta towards Lahore, some one or two hundred miles, and to creep over the other 20,000 miles of main lines, as we do now. And in the meantime, what are we spending on transit throughout the country? Perhaps fifteen millions sterling a year.

Suppose we spend 100 lacks (one million sterling) a year on railways, and accomplish 100 miles, what will be our position at the end of twenty years?

Expenditure.

Twenty years at 100 lacks (1 million) .	£ 20 millions sterling.
Extent of railway opened	2,000 miles.
Main lines required	20,000
Remaining unexecuted	18,000 miles.

Estimate of Results.

Traffic on 500 miles by road from Calcutta	500,000 tons a year.
Saving on do. as compared with river transit	Nothing.
Average traffic on 1,500 miles of other lines	50,000 tons.
Annual saving on do. as compared with land carriage at two annas (3*d.*) per ton per mile	90 lacks (£ 900,000)
Saving in twenty years, allowing half that amount for the whole period . . .	900 „ (£9,000,000)

Now, if instead of expending 100 lacks (one million) a year for twenty years, on complete railways, the same time and money be spent in other ways, the following might be accomplished:—

5,000 miles improved river navigation at Rs. 2,000 (£200) a mile........	100 lacks	(£ 1,000,000)
2,000 miles of Coast canal at Rs. 3,000 (£300) a mile..................	60 „	(£ 600,000)
3,000 miles of canal on other favourable lines at Rs. 5,000 (£500)......	150 „	(£ 1,500,000)
14,000 miles of cheap single railway at Rs. 12,000 (£1,200) a mile	1,680 „	(£16,800,000)
Total . . .	1,990 lacks	(£19,900,000)

So that we should have,

Good river navigation	5,000 miles.
Coast canal	2,000 do.
Other canal	3,000 do.
Cheap railway	14,000 do.
Total . . .	24,000 do.

Results.

Saving on 500 miles of Ganges at two pice ($\frac{1}{4}d.$) a ton on one million tons..	50 lacks	(£ 500,000)
Do. on 800 miles of Indus, at two pice ($\frac{1}{4}d.$) on 50,000 tons	4 ,,	(£ 40,000)
Do. on 2,700 miles of other rivers, at two and a half annas ($3\frac{3}{4}d.$) on 50,000 tons	216 ,,	(£ 2,160,000)
Do. on 2,000 miles of Coast canal at three pice ($\frac{3}{8}d.$) on 50,000 tons	15 ,,	(£ 150,000)
Do. on 3,000 miles of other canals at two and a half annas ($3\frac{3}{4}d.$) on 50,000 tons	240 ,,	(£ 2,400,000)
Do. on 14,000 miles of railway at two annas (3*d.*) on 20,000 tons	700 ,,	(£ 7,000,000)
Total saving ...	1,225 lacks	(£12,250,000)
	or $12\frac{1}{4}$ millions sterling.	
Or in 20 years, (taking half of this for the average of the whole period)	122 ,,	,,

That is, if grand railways are carried on, we shall, at the end of twenty years, have 2,000 miles of main communications, or *one-tenth* of the main lines the country requires, and have saved nine millions sterling; whereas if we follow another system, first turning to account the facilities we have for water communication, and then proceeding with cheap railways, we shall, at the end of the same period, have *the whole* of the main lines opened, and have saved 122 millions sterling. In calculating the saving upon each line, I have, of course, compared it with the kind of transit for which it will be substituted, whether river, coast, or land carriage; and though this must necessarily be a very rude kind of estimate, yet there can be no doubt that it gives, in the main, a true representation of the case. In its simplest form, the question is, "Shall we first have eighty miles "of fine double railway, or 4,000 miles of good river navigation; and "when we have done what we can with water, shall we have 1,200 miles "of fine double railway, or 14,000 miles of cheap single railway?"

If, instead of taking a little strip of the country, and setting ourselves to ascertain whether a railway will pay, we take the whole country from the Himalaya to Cape Comorin, and consider what it most requires, and how the greatest advantage may be obtained in the shortest time, we shall have no doubt as to the main point, *viz.*, that grand railways will not answer our purpose. Nobody is more sensible than I am, that complete railways are the most perfect communications, and invaluable in an advanced country where there is a vast number of people whose time is extremely valuable; and to this state we may hope India will come in time; but what is most wise in a rich man, is utter ruin to a poor one, and to lay 100 miles of railway, and leave 10,000 miles of trunk lines unimproved, is as great a mistake as could be made. If we want fine

railways as soon as possible, the best way to obtain them, is, to take the shortest course to throw open the country; and by thus removing the insufferable burthen under which it groans, enable it to put forth its energies. Every mile of railway costs not only what is expended on it, but also what is expended on the fifty miles of land transit, for which, with the same money, as much river navigation might be substituted. Thus, if instead of spending ten lacks (£100,000) on the Godavery, the improvement of that line be delayed for twenty years, and ten miles of fine railway executed instead, there will be, on a traffic of 50,000 tons carried by land from the basin of that river (400 miles at sixty rupees (£6) per ton per mile), a loss of thirty lacks (£300,000) a year, or 600 lacks (six millions) for the whole period of twenty years; so that the actual cost of the railway, great as it may be, is a mere trifle in comparison of the loss that it causes. Further, this sum of 600 lacks (six millions) in money, is trifling compared with the full amount of loss to this vast tract, thus remaining closed against all the refreshing influences that a free communication through it would inevitably bring in. Who can form an estimate of the mischief thus done?

During the twenty years that it took to throw a net-work of railways over England, that country had the advantage of a complete system of canals and good turnpike roads. How totally different is the state of India, and what will it do during the 200 years that will be required at the present rate of progress, to provide it with railways! But the fact is, that this will never be done; people delude themselves with these railways, and fancy they are actually supplying the wants of India, while they are in reality doing nothing in comparison of what it wants.

But to return to the question of a canal, or river improvements, for the line from Allahabad to Calcutta. On the principle already advanced, of *speed in making communications*, I would certainly advocate the latter rather than the former, because the work could be completed in one-tenth of the time. Supposing we throw more water into the river, at a cost of Rs. 2,000 (£200) a mile, then, the cost of the whole, 12 lacks (£120,000), would be realised in three months, if a saving of only one pie ($\frac{1}{8}d.$) per ton per mile were produced on one and a half million tons per annum; or, if the canal were begun at the same time and finished in five years, the cost of the river improvements would be saved twenty times over before the canal was opened, without taking into account the greater cost of the canal, *viz.*, Rs. 20,000 (£2,000) per mile.

If the money and labour already expended on railways had been spent on river improvements, we should already have 1,200 miles of very fair navigation, and be saving at the very least one pie ($\frac{1}{8}d.$) per ton; or on 1,200,000 tons for the whole 1,200 miles, seventy-two lacks (£720,000) a year. Such is the price we are now paying for our finery, because beggars as we are, we will be as great men in one point as our wealthy neighbours. Let us first get rid of our incubus by the readiest means, and let in the air and light to the dark interior regions of the country; and then we

may sit down and consider how to provide ourselves with the greatest luxuries in the way of transit.

I do not at all mean to insist on the kind of work above advocated as the only possible works; on the contrary, what I desire, is to see many minds exercised on this point; looking fairly at the whole subject, and considering what India requires as she now is, and how it may best be obtained. I am satisfied that the means I propose are incomparably more to the purpose than those now in progress; and that by their means we shall, in a tenth part of the time, attain the very objects we are now grasping at, *viz.*, rapid and luxurious travelling; but if any one can propose still better means, so much the better.

There seems to me, however, very little hope at present of any plan by which a greater extent of very cheap transit can be obtained in a short time, than by improving the rivers. When I speak of the works costing little, it is chiefly with reference to time. The saving effected by speedily getting rid of the present cost of transit, is, (as shown above), enormously greater than any saving in the execution of the works. On a line of land carriage of 100,000 tons a year, the present expenditure is about Rs. 20,000 (£2,000) a year per mile; and if this be continued for ten years, two lacks of rupees (£20,000) a mile will be lost; while the substitution of a cheap railway for it, would only cost perhaps Rs. 12,000 (£1,200) a mile, and the improvement of a river not more than Rs. 2,000 (£200).

As I have already said, something may be done in improving the beds of the rivers, but in general the first point is to throw more water into them; and I calculate that water can be stored at 2,000 cubic yards per rupee (2 shillings), an estimate which is the result of long experience among the tanks of the Carnatic. Without any remarkable advantage in the site, a bund may be made almost anywhere at this rate; but in many situations, where the form of the ground favours it, thrice this amount may be stored for a rupee (2 shillings). A bund, ten yards high, would cost in the Carnatic fourteen rupees (£1 8*s.*) a yard, and if the fall of the country were ten feet a mile, and the water stood eight yards deep at the bund, it would retain 17,000 cubic yards of water for every yard length of bund, with little assistance from the form of the ground. If the fall of the country were less, the quantity of water retained would be proportionably greater; and it is to be observed that in India generally, the slope of the country is much less than in the Carnatic.

It must also be remembered, that in choosing sites for tanks to store water for the rivers, we should have the choice of the whole of the upper part of the basins of those rivers. It would not signify where they were situated; in some cases, no doubt, it would be necessary to purchase land: but the wildest and most uncultivated parts would generally be chosen.

There are many tanks in the Madras Presidency, each of which contain water enough, alone materially to improve the navigation of the Goda-

very; and were our Government to take such a matter in hand, no doubt sites could be found to contain a much larger body of water than any existing tank holds.

What quantity of water it might be desirable to throw into other rivers, such as the Ganges, I do not know; but of this I have no doubt, that the cost would bear no comparison with the benefits, if such an immense traffic as that on the Ganges were facilitated. If the water at a shallow be 1,000 yards broad, and the current two miles an hour, it would require thirty million cubic yards a day, or 3,000 million cubic yards for 100 days, to keep it a foot deeper. This might cost about thirty lacks (£300,000); a very small sum to benefit a navigation of suppose 700 miles, on which a million tons pass annually. The interest of it would be equivalent to about one-tenth of a pie ($\frac{1}{80}d.$) per ton per mile for those 100 days; and probably it would save twenty times as much in the cost of transit. But what is now doing on this line? It is proposed to spend one lack (£10,000) a mile on 500 miles of railway; a sum that would supply 250 million cubic yards of water a day for 200 days, sufficient to provide a stream 2,000 yards wide, and three feet deep, flowing at three miles an hour, which would make the Ganges throughout the year a perfect navigation for steamers drawing five or six feet, besides effectually protecting the country from floods. But there is not the least occasion to go to any expense approaching to this; the cost of fifty miles of railway will certainly give 700 of excellent river navigation. As I have said before, on the Ganges line something more *must* be done besides laying a railroad; for I suppose it will not be expected that even a double line of railroad will convey two million tons a year, or on *an average* about 7,000 tons a day, besides passengers; in which case it might, on some days, be required to convey 14,000 tons and 5,000 passengers. The traffic which cannot be carried on the railroad must be provided for in some other way. Is it finally determined to leave the greater part of the traffic with all the present disadvantages? This is out of the question. Suppose that only half a million tons are left to go by the river from Allahabad to Calcutta, on an average of the whole distance, the cost of the traffic by river (according to the railway advocates' calculations) will be as follows: 500,000 tons × 9 pice × 600 miles = 140 lacks (£1,400,000) a year. Is this to be allowed, while at least 100 lacks (one million) a year, might be saved by improving the river, at a capital cost of perhaps thirty or fifty lacks (£300,000 to £500,000) or an annual expense of one and a half or two and a half lacks (£15,000 to £25,000).

I am not aware what the cost of the projected canal from Calcutta to the Ganges was estimated at; but whatever it might be, it would not affect my position, because what we want is *immediate* relief. We have to deal with a loss of 100 lacks (one million) a year; and if we take in hand a work which will require five years to execute, we ensure a loss of five millions sterling.

CHAPTER VIII.

CHEAP RAILWAYS FOR LOW SPEED, AND RAPIDLY CONSTRUCTED.

Time in forming Communications, the fundamental point.

In the question of supplying India with the means of transport, the fundamental point is, *time—the time in which the communication can be formed, and brought into operation.*

Let us first take some line,—not one on which there is such an extraordinary amount of traffic as on the Ganges, but yet one of considerable traffic, which may be considered a fair specimen of the ordinary main lines of the country, such as the line between Madras and Bombay (760 miles). The present traffic on this line has been ascertained near each end. The total cost of traffic on the Thull and Bhore Ghauts together, (as given in the published reports), is about Rs. 22,000 (£2,200) per mile per annum; and the average rate near Madras is about Rs. 12,000 (£1,200) a mile, for goods only. The mean of these two is about Rs. 17,000 (£1,700) a mile; and if this diminishes from the Ports towards the interior, till at the centre of the line it becomes scarcely any thing, then the average of the whole will be about Rs. 8,500 (£850) per mile. But it is quite certain, that if very cheap and expeditious communications were opened along this line, a vast quantity of traffic *now existing*, which at present makes for the Ports by the shortest routes, would be brought by the nearest way to each point of it; and hence we may safely conclude, that of the present traffic, much more than the above average would pass along the new communication; perhaps nearly double, suppose to the amount in all, of Rs. 15,000 (£1,500) per mile. If then the actual cost of transit, (including interest), were reduced from two and a half annas ($3\frac{3}{4}d.$) to one-fourth, *viz.*, five-eighths of an anna (1*d.*) there would be a clear saving of Rs. 12,000 (£1,200) a mile on existing traffic. But, as before argued, in the case of such a diminution of cost, there will be at least as much property saved, by the conveyance of goods which could not be moved before, on account of the expense; so that we may reckon, that on the average, there would be a saving of Rs. 24,000 (£2,400) a mile, or on the whole line (Rs. 24,000 × 760 miles) a saving of 180 lacks, or £1,800,000 sterling per annum. Now if a new road be carried across this space, at the rate that the Bombay railroad is going on, (about twelve miles a year), beginning at both ends at once, the dis-

tance will not be accomplished in less than thirty years; and even allowing that the parts on which is the greatest traffic are executed first, still, taking 180 lacks on 760 miles for thirty years = 5,400 lacks, about one-third of that sum, *viz.*, 1,800 lacks (18 millions sterling) would be lost during the thirty years. But of course we must reckon upon the traffic greatly increasing during that time, owing to the general improvement of the country, if, as we hope, a new order of things prevails; and on this account we may fairly reckon the loss, from the delay of the work, at twenty-five millions sterling, or £33,000 a mile (Rs. 3,30,000) for the whole period; so that to the cost of a railroad we ought to add this sum, with its accumulations of interest; making in all about five lacks of rupees (£50,000). If, therefore, the railroad cost only half a lack (£5,000) a mile, it will thus appear that the time in which the work can be executed, is ten times as much importance as the cost of the work itself.

We shall thus find it better to spend double or treble on any work, than to delay its execution; and, supposing it were necessary in order to get the communication completed in half the time, to lay out double the money upon it, the account would stand thus: On the one hand,

Cost of constructing 760 miles at half a lack (£5,000)	380	lacks	(£ 3,800,000)
Interest and working at Rs. 4,000 (£400) (one-fourth of present cost) a mile per annum, for half of thirty years (fifteen years) . . .	456	do.	(£ 4,560,000)
Expenditure for fifteen years' transit on common roads as above Rs. 16,000 × 760 × 15 years . .	1,824	do.	(£18,240,000)
Total expended in thirty years on railroad slowly constructed	2,660	do.	(£26,600,000)
On the other hand:			
760 miles at one lack (£10,000) . .	760	do.	(£ 7,600,000)
Interest and working at Rs. 4,000 (£400) a mile for half of fifteen years (seven and a half years) . .	228	do.	(£ 2,280,000)
Do. do. for last fifteen years of the thirty years.	456	do.	(£ 4,560,000)
Expenditure in transit on common roads, for half of first fifteen years (seven and a half years) . .	912	do.	(£ 9,120,000)
Total expended in fifteen years on railroad speedily constructed . .	2,356	do.	(£23,560,000)
Saving by speedy execution.	304	do.	(£ 3,040,000)

Or, there would be a saving in the thirty years, of three millions sterling, by laying a railway in half the time at double cost; but even this does not allow for the gradually increasing traffic, nor for the amount lost in interest, which would tell very greatly in favour of the second calculation.

The real question is then, What is the kind of work that can be most rapidly carried across? Supposing that it were a cheap railway which could be executed in two years, at an expense of Rs. 20,000 (£2,000) a mile, and could be worked as cheaply as the other, (the additional cost of draft on a less perfect road being counter-balanced by the diminished interest), the calculation would then stand as follows:—

760 miles at Rs. 20,000 (£2,000)	152	lacks	(£ 1,520,000)
Working, &c., at Rs. 4,000 (£400) a mile for thirty years....	912	do.	(£ 9,120,000)
Expended on transit by common roads during the execution of the work..................	62	do.	(£ 620,000)
Total for cheap railway.....	1,126	do.	(£11,260,000)
Total expenditure on expensive railway made in thirty years, as above shown..............	2,660	do.	(£26,600,000)
Do. on cheap railway completed in two years..............	1,126	do.	(£11,260,000)
Saving by cheap railway....	1,534	do.	(£15,340,000)

or $15\frac{1}{2}$ millions sterling nearly.

In other words, if the cost of transit of the present traffic, including what is brought on to the line in consequence of its improvement, be Rs. 24,000 (£2,400) a mile, and it could be reduced to a quarter of that sum by a railroad, there will be, for every year the work is delayed, a loss of Rs. 18,000 (£1,800) a mile, or 137 lacks (£1,370,000) on the whole line; and it would be as cheap, if necessary, to spend a lack of rupees (£10,000) a mile on it, and do it in one year, as it would be to spend Rs. 10,000 a mile on it, and do it in ten years. Thus,

Cost of one mile of road............	Rs.	10,000	(£ 1,000)
Loss by excess of expenditure on one mile of common road during time of execution (ten years) allowing half of the whole length for the average....	,,	90,000	(£ 9,000)
Total expenditure.....	Rs.	1,00,000	(£10,000)

The immediate question then seems to be, *By what means can the greatest extent of line be opened in a certain time?* which leaves entirely open the final question, *What may be the best ultimate kind of communication?* This simplifies the matter exceedingly; and under this view of the case, there can be no doubt, that while such a railroad, as that now under execution at Bombay, is creeping across the country at suppose twelve miles a year as at present, or even allow 100, it is advisable at all events in the meantime to execute another more rapid though less perfect work, which would have the important effect of at once giving full value to whatever portion of the superior work is executed, by bringing the whole traffic down to it, just as if the main line were completed. What we want then, is a ready-made railroad that we can buy out of hand, and which will require little work to put it on the ground; and it is evident, that with such means, we might at once have a railway wherever a line would pay the interest of the money; and this on any number of lines.

When this point is once acknowledged, and the minds of many are turned to discover what will be the best kind for our purpose, no doubt many suitable ones will be found. The one I should propose, (for the low tracts at least), is simply a series of wrought iron beams supported on cast iron posts, screwed into the ground with Mitchell's Patent Screw. The beams might be from twelve to twenty feet long; and such beams are now being rolled without difficulty. They should be very deep of course; and the upper surface need not be more than one and a quarter inch broad, for I would not think of working these roads at very high speed, or with heavy wagons. They would not have to bear a twentieth of the weights used on the English roads; and consequently need not have a surface of half the breadth. On the higher tracts, and where low embankments are required, I would lay down one of the new forms of rails, with a broad base, requiring neither chairs nor sleepers. I would allow considerable slopes on these lines, and if, as is generally the case in India, there be a decided preponderance of traffic in one direction, there should be greater slopes in that direction than in the other. It would probably be quite sufficient to have gradients of one in 100 one way, and one in seventy or eighty the other. *Cuttings* to a small extent might be made, but I would have no embankments of any height in the first instance; and as the drainage of the country would not be interfered with, no masonry works would be required. The rivers would be crossed by high screw piles; or it might be worth while in some places to have narrow masonry piers, involving but little work. The iron beams must be stayed across at intervals, to secure the gauge. It would be a question on some lines, whether cast iron or teak posts should be used; but as the former could be got in any quantities, and could always be used in another place, when they had done their work where first erected, they would be preferable in general. From the general state of the surface of the country in India, a very great extent of line could

be formed with the above slopes, without any excessive height of posts; and where the country was not so favourable, one of the following plans might be adopted. High posts (either cast iron or teak) might be screwed in to a good depth, and, if necessary, supported by being placed at a small angle towards each other, (instead of perpendicular), which, with the screw, would give immense stability; or else a series of masonry piers might be raised, or a regular embankment be formed, or greater gradients might be allowed for that division of the road, and additional horses or engines used. It must also be particularly observed, that the more difficult country will generally be about the water-sheds and furthest from the Coast, where the traffic will be the least, perhaps not more than a-tenth of that nearer the Coasts; so that it is by no means essential to have such moderate gradients there, as in the lower parts of the country.

I have supposed that these lines will be worked at a moderate speed; as our choice at present is, not between a high speed and a low speed, but between a low speed and none at all. *One thing is certain, we cannot have the complete railroads laid at once all over the country.* The present question is not, whether at the end of fifteen years we are to have 15,000 miles of high speed railway, or 15,000 miles of low speed lines; but rather, whether we are then to have 1,500 miles of high speed line, and 13,500 of common roads, or 1,500 of high speed, and 13,500 of low speed railway. What an absurdity it is then to insist on either high speed, or nothing; to travel 100 miles out of a 1,000 at forty miles an hour, and the remaining 900 at three miles an hour! The point of speedy travelling is altogether insignificant in the present state of things in India, in comparison with cheap transit generally; and further, this plan for quickly covering the country with cheap communications does not in the least interfere with the question of speedy transit; but, on the contrary, will immensely assist it, by completing the lines, though imperfectly, years before they could otherwise be completed at all.

I am of opinion that Mitchell's Screws will give immense stability to the posts, by enabling us to insert them into undisturbed ground; and the question will be, what depth it may be necessary to insert them, and whether one or two lines of posts will be required. Probably a single post, with a cross hand beam to support the two rails, would be sufficient. How very little height will be required in some parts of the country, is shown by the levels for the Madras and Arcot railway, which only requires an average height of bank of four and a half feet, with gentle gradients. Such a screw-pile railway would not be very expensive; but even if it were, the rapidity with which it could be put up would compensate for a very great cost, if necessary; for, as shown above, no less than Rs. 24,000 a mile are every year lost in cost of transit for want of a proper line. The estimate for a mile of this proposed railway may

be something like the following, supposing that two-thirds are over low ground, and that two lines of posts are used :—

176 cast iron posts averaging eight feet in length, and weighing 4 cwt. each (in all 35 tons, at £8)	Rs. 2,800 (£ 280)
176 rolled iron beams twenty feet long, 80lbs. per yard, or 5 cwt. each, (44 tons at £10 a ton)	„ 4,400 (£ 440)
2,400 yards of broad flanged rail at 40lbs. (44 tons at £10)	„ 4,400 (£ 440)
Excavation 16,000 c. yds. at one anna...	„ 1,000 (£ 100)
Sundries	„ 3,000 (£ 300)
Total Rs....	15,600 (£1,560)
Say, at the utmost, Rs....	20,000 (£2,000)

Such a road should be furnished with very cheap buildings; and if worked with light loads, and at low speed, with cattle or very light engines, ought scarcely to require any repair; what I would particularly insist upon, being, that the loads should be so light as not in the least to affect the way. One of the most essential points in such works is, if possible, to have no masonry at all, because that most retards their execution; whereas, if there be only a little earth-work to be executed on the road, and the rest of the expenditure is on rails and other things that can be obtained at once, 1,000 miles of line could be executed in a single season.

With respect to the cost of working such a road, we have the following data.

The actual expense of draft in England at high velocities, is about $\frac{1}{5}$*d.* or one and a half pie per ton per mile, and, allowing for these roads having steeper gradients on the one hand, and on the other being worked at a lower speed, we might take the expense at the same rate as at home; but as labour and materials are so much cheaper in this country, we may on this account reckon that the cost will certainly be less than in England, suppose $\frac{1}{8}$*d.* or one pie per ton per mile.

Again, the cost of conveyance by bullock carts on a good made road here, is about one anna ($1\frac{1}{2}$*d.*) per ton per mile, (exclusive of carrier's profit); but the cost of bullock draft on such a railway would be reduced to about one-sixth, on account of the diminution of resistance, and this would give only about two pice ($\frac{1}{4}$*d.*) per ton. Again, from results already obtained in this country, we may safely calculate steam-power on a railway to be only half the cost of that of bullocks, which would reduce the cost to one pie ($\frac{1}{8}$*d.*) per ton per mile, the same as obtained by the former calculation. Upon the whole, therefore, I think we may take one pie ($\frac{1}{8}$*d.*) per ton per mile, as the cost of draft.

The calculation for working this kind of railway might then be as follows:—

10 per cent. interest on, say Rs. 20,000	Rs.	2,000 (£200)
Management	,,	100 (£ 10)
Repairs	,,	100 (£ 10)
Sundries	,,	300 (£ 30)
Total	Rs. ...	2,500 (£250)

Which, divided between 144,000 tons, gives general charges per ton	$3\frac{1}{2}$ pice	($\frac{1}{2}d.$)
Cost of draft per ton................,	1 pie	($\frac{1}{8}d.$)
Total charge per ton per mile....	$4\frac{1}{2}$ pice	($\frac{9}{16}d.$)

Or about one-seventh of the present cost of transit.

In previous calculations I estimated the charge at one-fourth of the present rates. Here, it comes to only one-seventh, even reckoning the whole of the charges of the railroad as paid nearly equally by travellers and goods; whereas, probably, almost all the charges would be paid by travellers, and goods charged with *little* more than the bare actual expenses, thus enabling us to get the utmost advantage from the line, and reducing the charge for goods to a very small item.

Thus, if the present number of travellers be only 1,000 per day, and if cheap and comparatively rapid conveyance increase them fourfold, the total number of persons conveyed per annum would then be 1,460,000; and the charge for each on account of interest (even if paid entirely by travellers) would be only one-third pie ($\frac{1}{24}d.$) per man per mile, so that the total charge for the poorest class of passengers (all expenses included) might thus still be under one pie ($\frac{1}{8}d.$) per mile.

Respecting the present number of travellers, we have the following data:—

On the Bhore Ghaut.. 284,000 per annum,
or 800 per day.

We have no other statistics of passenger traffic on this line; but the following shows how enormous it is in the country generally:—

On one main road in Tanjore (1837).......................... 1,289 per day.
On another... 1,550 do.

and these not in the immediate neighbourhood of any great town. Now, if men travel in these numbers without any one facility,—having to walk, and therefore only able to travel at the rate of twenty miles a day, so that on a journey of two hundred miles and back, they must be absent from their work and their families at least three weeks,—we cannot doubt, that if the same could be done in two days, and at less expense than it would cost a man to walk, the intercourse would be immense; probably more than quadrupled.

I have myself no doubt that passengers will abundantly pay the interest, &c., for the railway; so that goods may be carried at the bare

cost of transit. In England, even at the comparatively high speed there, some goods are now carried at ½*d.* or four pice per ton per mile, still allowing some profit; and if in this country goods could be carried at even two pice (¼*d.*) (one-fifteenth of the present cost) it is difficult to estimate what the increase of traffic will be. When a ton can be carried one hundred miles for a rupee (2 shillings), a very trifling difference in the market price at two points will be sufficient to cause a thing to be transferred from one to the other. Thus, if grain be worth thirty rupees (£3) a ton in one place, a small difference in value, say 6 per cent., or two and a half in forty seers per rupee (2 shillings), might be sufficient to give rise to a trade between that and another place two hundred miles off. The coarsest goods, such as firewood, building materials, straw, &c., would be carried hundreds of miles; and we need not be surprised if the goods traffic increased nearly tenfold, like that through the Paumbam Channel since its improvement.

If we allow the total cost of draft, interest, &c., on such a road as this executed in two years, to be (as first assumed) one-fourth of the present cost, then, the comparative results of this, and a complete railway begun at both ends at once, and executed at the rate of fifty miles a year, (or four times the rate they have been working at Bombay), may be thus calculated :—

760 miles at Rs. 20,000 (£2,000).......	152	lacks	(£ 1,520,000)
Transit (at one-fourth present rate) Rs. 4,000 (£400) a mile for fourteen years. .	425½	„	(£ 4,255,000)
Cost of working one-half (380 miles) as common road, for two years, at present rate, Rs. 16,000..................	121½	„	(£ 1,215,000)
Total expense...	699	„	(£ 6,990,000)
Again,			
760 miles at Rs. 1,00,000 (£10,000).....	760	lacks	(£ 7,600,000)
Cost of working one-half (380 miles) at one-fourth present rate, Rs. 4,000 (£400) a mile for fifteen years.............	228	„	(£ 2,280,000)
Do. of half at present rate, (Rs. 16,000) .	912	„	(£ 9,120,000)
Total expense...	1,900	„	(£19,000,000)
Loss by waiting for complete road......	1,201	lacks	(£12,010,000)

or twelve millions sterling.

If we suppose that traffic would be increased fourfold by improved communications, we must add to the above difference the loss occasioned by non-transport for fifteen, instead of two years, of three-quarters of the goods; and further take into account the incalculable loss from postponement of passenger traffic, besides loss of interest.

This will help to give us some notion of what we are now paying for high speed complete railroads; for (as shown above) these roads would,

on account of delay in executing, cost two lacks (£20,000) a mile more, in point of fact at least four lacks (£40,000) a mile or more, in money, considering the delay in the additional traffic; and besides this, all the loss that cannot be shown in money. Even supposing that the above calculations require great correction, they will still leave no possible room for question as to the main point, viz., *that nothing can compensate for loss of time in opening the country;* and therefore I repeat, that although a railroad that could be laid in a year should cost four or even ten times what I have calculated, there can still be no question but that it ought to be done at once, rather than wait.

I do not pretend to say that these railways are the best possible means of accomplishing our object; on the contrary there may be much better. What I *chiefly* wish to show is, first, that what is most wanted is *speed, not in travelling on the railways or canals when executed*, but *in executing them;* and, secondly, that it is quite possible to have a kind of communication that can be quickly executed.

The railway proposed above would have the following advantages:—

1st. It could be executed at any rate of speed since England could provide rolled and cast iron in any quantities; and at the rate of 100,000 tons of cast iron and 130,000 tons of rolled iron supplied per annum, 3,000 miles a year could be executed, and the whole extent of main road required (15,000 miles) thus easily completed in five years, (at the rate of 3,000 miles a year). Supposing then, that Rs. 1,000 (£100) a mile were spent on the ground, it would only require an expenditure of thirty lacks (£300,000) a year; which, if fifteen main lines were begun at once at both ends, could easily be managed so that one lack (£10,000) would be spent annually on each portion of the undertaking. Thus about 200 miles of the most important part of each main line would be finished each year; or else only five of the most important lines might be begun at once, and 600 miles of each would be finished every year.*

* We have happily already some instances, showing the rapidity with which works can be executed in India. The two masonry weirs across the Colleroon (one 800 yards long, and the other 680) were both completed in the same three months. One branch of the Godavery weir (960 yards long) was carried in one fortnight across to such a state of completion as to allow of the water going over it. The Nuggaram aqueduct over a branch of the Godavery, (800 yards long, and containing forty-nine arches of forty feet), built in a tideway, had the last arch keyed within four months from the time of commencing to make bricks. This work is twenty-eight feet broad; and it was ready for the water to go over it in about seven months from the same time. It is built with the crowns of the arches seven feet below the surface of the water in the river; and before the side walls could be finished, a tremendous flood occurred, which went two or three feet over all and entirely submerged the work for five days, but without injuring it. Great precautions had of course been necessary to secure the foundation under such circumstances, in the bed of a river consisting wholly of loose sand; and, under Providence, these precautions were completely successful. It is highly encouraging also to find, that far from these sandy rivers being almost insuperable obstacles, (as has been supposed), works can be constructed there, which will allow of the river going over the parapet walls, without injuring the work. This, as well as hundreds of other works of various kinds, bridges, aqueducts, rivers, sluices of all descriptions, &c., have been built in rivers in the Madras Presidency where there was not a vestige of anything

2nd. As soon as any portion of the line was laid with more complete work, the former could be taken up and placed on another line, at a trifling cost. If worked with light loads, it would last for ever; or at least for so many years as would amount to much the same.

3rd. By laying down these lines we should leave ourselves quite at liberty to pursue further plans at leisure; and we should have the great advantage of thus feeling our way, and, in laying permanent lines, have the experience of these temporary ones to help us to judge whether they were quite the best that could be adopted.

4th. These lines would be of the greatest use in the execution of more complete works by the conveyance of materials.

5th. Even if any sections of the lines contained very heavy works, that need not delay the opening of the other parts of the ultimate line, as these might be worked in the meantime; and such a work, therefore, as the ascent of a ghaut, or a long tunnel, might be executed on the best plan, even though it took many years to finish it.

6th. Such a line might be put up anywhere where it would be of use for the present, although it were probable, or even certain, that it would not ultimately form a portion of any permanent line.

7th. If it were found to increase the traffic very greatly, there could be no objection to adding a second line, though both were to be eventually superseded.

8th. It must be remembered, that it is hardly possible for us to judge what changes may take place in consequence of these powerful agents being brought to act upon a country hitherto so neglected. As yet, every thing has been cramped and forced into certain places and lines by natural obstacles; but when the natural resources of the country are set at liberty by the opening of the country generally, so as in fact to remove natural obstacles, most unexpected changes may take place. One change is almost certain, *viz.*, that all the minor ports will become places of extensive foreign trade, by the settlement of European merchants; and thus much more of the trade will go from the interior to the nearest ports, than at present. Certain spots, which are the most suitable for certain kinds of produce, but are at present unavailable on account of the cost of transit and their inaccessibility to the European merchant or manufacturer, will then be applied to the purpose for which they are naturally suited. For instance, many places two hundred miles from a port, now not available for sugar cultivation on account of the transit costing £3 a ton, would be highly profitable plantations if the transit cost only 10 shillings a ton. These temporary lines would soon bring such things into view, and might materially modify the decisions upon the permanent lines.

but loose sand, to an unknown depth; and have been standing for many years; probably not one of them has foundations ten feet deep, and in general they are not more than six or eight feet.

9th. By no means an insignificant result of this plan would be the considerable demand that it would make on England for one of its most important products and manufactures; and an annual consumption of 230,000 tons of iron for many years would have a very perceptible effect on the iron trade.

We may now consider some objections that may be made to this kind of road. Probably the first will be, that a raised road will be more dangerous than an ordinary one. There is no doubt that there will be some little additional danger to travellers; but it will be very little. In the first place, I propose that these lines be worked at a much lower speed than the complete roads; and it is certain that with low speed there would be scarcely any accidents, since almost all that now occur are caused by high speed. Secondly, I would work goods and passenger traffic at the same speed, so that the chances of collision would be almost entirely removed. Thirdly, I cannot but think, that upon the whole, in this country there would be less danger of loss of life on a road of which a great part was raised on posts above the level of the country, than on one which men would be frequently crossing, or even walking along. Considering the apathy of the Natives, we must expect many accidents to happen to stragglers on the roads, if made accessible; and thus the raised lines would remove some sources of danger to passengers. At the Godavery works, one man actually walked straight up against a loaded wagon coming towards him at three miles an hour, and was knocked down backwards, the carriage passing over him as he lay between the rails. At any rate, however, the danger on such roads, worked at eight miles an hour, would be much less than that on the present railroads in England, worked as they are at thirty or forty miles an hour, and with trains running at different speeds; and as people do not object to run the risk there, the smaller risk cannot surely be an obstacle here. If thought desirable, planks might be laid between the rails, resting on the cross stays which connect the rails, in order to enable persons to stand on the road in safety; but probably it would be better so to arrange that persons could not pass on foot along the line of the road, excepting on the ground along which a path might be made. At rivers and channels, a line of planks supported on brackets below the level of the rails, could be placed outside the posts, so as to form a foot bridge; but all such minor points would easily be settled when once such a line is laid. In other respects this kind of road would be exceedingly secure; the beams would be fixed in a deep *notch* cast in the post, and secured by a horizontal stay, the ends of which should pass through both the beams and the posts, having nuts screwed on outside the *latter*, to hold them against shoulders on the stay. I do not see what further objections could be made to such a structure.

I have before spoken of the breadth of the top of the rail. On the present rails only two and a half inches broad, engines of thirty tons and

wagons of seven tons are run; so that there can be no sort of question, but that a bearing surface of one, or one and a quarter inches, would be sufficient for such a road as this, with loads of only one ton.

If thought advisable, both posts and beams might be made of teak instead of iron, which would cost probably about Rs. 8,000 (£800) a mile less; and a plain square bar of one and a quarter inch iron might be laid on the timber, and secured by deep screws, (as in America), only with the difference of a square bar, instead of the broad thin one used there. The difference between a bar of five-eighth inch and one of one and a quarter inch thickness is immense; and the trial on the screws would be nothing with the latter as compared with the former. A great mistake was made at the Godavery works in making all the railroads with bars only half inch thick and two inches broad, for five ton gross loads. Square bars of the same weight would have been much better, as they give sufficient height for the *flange*, without cutting away the wood. Probably the broad thin bar was used in America, for the same reason as it was at the Godavery, by mistake; it not being considered, that if engines of thirty tons could run on a surface of only two and a half inches in breadth, there could be no necessity for so great a breadth for light engines.

If it be still urged "We *must* have high speed," the answer, so far as the present question is concerned, is, "Have it by all means, as soon as you can;" but this does not affect the present proposition; which is, for something to supply the place of common roads, whilst high speed railways are under construction. Because you insist upon going along the first 100 miles at forty miles an hour, there is no necessity for our going along the next 500 at three miles an hour.

The present high speed railways are most important works; but, like every thing else, they may be proportionately mischievous if injudiciously used. Assuredly, up to this time they have done nothing but mischief in this country, by making people suppose that they were doing something, whilst they really were doing almost nothing; and have thus occasioned many years' delay, and prevented any thing being done which would really throw open India. It is just as if a man took wheat out of a bushel grain by grain to eat, and so died of starvation, while constantly employed in eating. Suppose that in ten years from the commencement of these high speed railways, there were in all 500 miles finished (and one of them too on the present cheapest line of transit in India) still, only half a million a year would be saved to the country, out of the twenty or thirty millions that *general want of communications* now costs her; whereas, within the same ten years, the whole of India might with the greatest ease have been pervaded by lines of cheap transit, and an enormous saving thus effected.

CHAPTER IX.

CONSIDERATIONS AS TO THE TRUE VALUE AND COST OF HIGH SPEED OF TRANSIT.

Cost of High Speed disproportionate to gain in Time.

One of the fundamental points to be settled, before determining on a system of communication, is *the value of time in the transport of goods and passengers.* Speed, like every thing else, may be bought too dear; and one thing is certain, *viz.*, that *increase of speed, whether by land or by water, by railways or roads, involves an increase of expense much more than proportional to the gain of time.* In fact, the increase of cost in high speeds is enormous; and both poor individuals and poor communities will find rapid transit so much beyond their means, that, in order to purchase it, they must impoverish themselves so as greatly to retard their progress. They may obtain rapid travelling in an isolated case, but it must be at the cost of greatly delaying the attainment of this object generally. If a poor man aims at having the means of keeping his carriage and travelling fast whenever he likes, he must not, while he is still poor, spend his spare money in buying a carriage.

The question therefore stands, "What the cost of speed is?" and in the case of any particular country, "Whether it can be afforded?" The cost of speed in water transit can be pretty well calculated, as a double velocity through the water produces a fourfold resistance, and therefore four times as much power is required to convey a thing a certain distance at a double speed; and there is a further consumption of money in consequence of the necessity of having in operation a power proportioned to the additional speed, as well as to the additional resistance. A boat going at a double speed, meets with a fourfold resistance; and if it be necessary that the power to overcome this fourfold resistance should pass through a double space in a certain time, it then requires eight times the power to be in operation, though for only half the time. Further, the machine which produces this power must itself be carried; and its weight and bulk must increase with the increase of power. Besides this, there are various other minor sources of waste in using high speed, so that we may reckon that a double speed afloat requires at least a sixfold expense, besides the inconvenience of having to provide a greater Capital. That is, a man may travel at the rate of five miles an hour for one-sixth of the cost at which he can travel at ten miles an hour, taking into calculation interest, consumption of materials, and everything else. He would also have to raise about a sixfold Capital,

or perhaps much more; but that is of course a separate question; he might be able to afford the additional current expense, but yet be quite unable to raise the required additional Capital at all, or at least not without so crippling himself in other ways, as to render it upon the whole unadvisable. If a merchant has credit, he of course considers how he may apply that amount of credit so as to produce the greatest profit.

As regards land transit, it is now clearly ascertained that the increase of cost for increased speed follows much the same law as afloat. On a common road, horses require so much of their power for moving themselves at higher speeds, as rapidly to absorb the greater part of it; thus leaving only a small portion to produce useful effect, and at the same time the resistance rapidly increases. The same also is the case with railroads: the resistance increases, and a large portion of the power of the engine is absorbed in moving itself. But besides this, there is in the case of railroads an enormous increase of *first* cost in constructing the road. For high speeds a most perfect apparatus is required, enormously heavy engines, and consequently rails of immense weight; most secure fastenings, &c., and also gentle slopes and easy curves, at a cost in excavation almost incalculable in some instances. It is well known, that the effect of a blow on the rails increases as the square of the velocity; and hence, an engine of double weight, moving at a double speed, strikes the rails with eight times the force. There is also another source of increased expense in the case of a railroad. If a high speed be required where the traffic is considerable, a double line is unavoidable; for if there be only a single line, either the quick trains must start at long intervals, or all trains must travel at the same speed, (and that a moderate one), because the great bulk of goods being of small value, are not worth the cost of transit at high speed. Thus, the Capital required for high speed by railway would be immensely increased; and the high interest consequent thereon, would also greatly increase the actual cost of transit; and therefore, whatever means we use, *we must pay very high for speed.*

The question is then reduced to this, "Are our circumstances in India such as to render it advisable for us at present to enter upon a general system of communication that will afford a very high speed?"

Let us first try and form some judgment of the actual cost of high speed on a railway as compared with low speed by the same means of transit. It is said, that the present Calcutta railway will cost one and a quarter lacks (£12,500) per mile for a double line, the interest of which, at a little above the present Government interest, suppose 6 per cent., will be Rs. 7,500 (£750) a mile per annum, or twenty-four rupees (£2 8*s.*) a day, excluding Sundays. The goods traffic on this line is immense; some accounts say two million tons a year. We have no means of ascertaining what amount of goods the railway would convey if worked at lower cost than river navigation; but if we suppose,

that while worked at high speeds for passengers, it would convey 2,000 tons a day, then the interest (if borne entirely by goods) would come to two and three-quarter pice (nearly $\frac{3}{8}d.$) per ton; and if to this be added the English rate of cost for working the roads, *viz.*, two pice ($\frac{1}{4}d.$) per ton, it would make the total charge four and three-quarter pice (nearly $\frac{5}{8}d.$) per ton per mile. The prices by river are at present about four pice ($\frac{1}{2}d.$) (including interest and insurance); by a perfect common road eight pice (1*d.*); by a less perfect metalled road fourteen pice ($1\frac{3}{4}d.$); by a common unmade road three annas ($4\frac{1}{2}d.$), and by canal half pie ($\frac{1}{16}d.$). Supposing, however, half the interest were paid by passengers, the portion still chargeable on goods would be twelve rupees (£1 4*s.*) a day, or one and three-eighths of a pie (nearly $\frac{3}{16}d.$) per ton; and the total charge would then be three and three-eighths of a pie ($\frac{1}{2}d.$ nearly) or perhaps (allowing cost of draft, &c., to be less than in England, say one and five-eighths of a pie, about $\frac{3}{16}d.$) not more than three pice ($\frac{3}{8}d.$). Let us now suppose the railway worked at low speed,—say eight miles an hour—in which case all trains would travel at the same rate, so that a single line of rails would be sufficient; and as only very light engines would be necessary, light rails might be laid, and a vast reduction would be made, both in cost of construction and in wear and tear, &c. Such a line might no doubt be laid at one-tenth the cost of the other, or Rs. 12,500 (£1,250); and the interest, *viz.*, two and a half rupees (5 shillings) a day, being divided (as before) between travellers and goods, would be only one-eighth of a pie ($\frac{1}{64}d.$) per ton, and the cost of transit, including wear and tear, would probably thus be reduced to one pie ($\frac{1}{8}d.$): the total charge being one and one-eighth of a pie ($\frac{9}{64}d.$) per ton, or about three rupees (6 shillings) per ton for 500 miles; whereas, the charge at high speed (as calculated above) would amount to eight or ten rupees (16 to 20 shillings) per ton, for the same distance. This is calculating on an amount of traffic three times as great as that on any railway in England, but with only 300 tons a day, which would still be a large traffic, the difference in amount of interest alone would be eight and a half pice (a trifle more than 1*d.*); or as much as the whole cost of carriage on a good common road, and probably fifteen times the cost of carriage on a canal.

But we must now see what the charge for travellers must be, in order to make up half the interest, (twelve rupees (£1 4*s.*) a day), as the cost of high speed; and this brings us to the main point of difference between this country and England as respects quick transit, *viz.*, the insignificant proportion of rich travellers here. Throughout India generally, the number of first class travellers (that is, of Europeans and Natives who can afford to pay very high rates) is extremely small; and the number who travel in Bengal and the N. W. by steamers and horse carriages is perfectly insignificant in respect to giving employment to a railway. We may form some idea of what number of first class travellers at certain

rates there would be, by considering the comparative state of things in India and England in this respect. The cost of travelling in England to first class passengers is about $2\frac{1}{2}d.$, or one and two-thirds of an anna per mile; and, allowing the value of money to be six times as great in this country, (by the comparative cost of food and labour), this will be equivalent here to about one-third of an anna, or four pice ($\frac{1}{2}d.$). If this rate were charged, would there be as many first class passengers as in England? In order to ascertain this, we must consider first, that the proportion of rich to the whole population is immensely less in India than in England, where we see more wealth in travelling one mile than in travelling a hundred miles in this country. On this account, the number of first class passengers would be perhaps scarcely one hundredth of the number in England, which (according to Dr. Lardner's statement) was in 1847, 157 a day on the average of some of the principal railways, and 360 on the line of greatest traffic. This, however, was not the number travelling over the whole length of the roads, but the total number of travellers over any part; the average distance travelled was forty miles, and the total length of road and branches being 438 miles, the average number of first class passengers for the whole length of the roads was only thirty-three per day. The greatest amount of travelling of this class was on the Eastern Counties railway, where it was equal to sixty-eight per day, passing over the whole length.

It must be remembered secondly, however, that the number of travellers in India generally will be greater in proportion than in England, because each great line of railway will affect a much larger population. Thus, each of the six lines of railway radiating from London, accommodates, on an average, one-sixth of the population of the United Kingdom, or nearly four millions; whereas the Ganges line will connect about sixty millions with Calcutta. This is a most material point to be considered in comparing traffic in India with that of England, where any particular line of road connects only a comparatively small number of people with a port or a market. Thus, notwithstanding the present imperfect communication on the Ganges, it has even now an amount of traffic in goods far exceeding any line in England; and we may therefore reckon, that other things being the same, the number of first class passengers would be perhaps ten times as great as in England. At present the total number of travellers in India to be called first class passengers, (that is, those travelling by steamers, and by palanquin or carriages), appears (by the railway pamphlets) to be daily about nine by the former, and thirty-three by the latter; in all forty-two per day, or two-thirds of the number of first class passengers, on the greatest passenger line in England. But then it must be remembered that they pay at present about five annas ($7\frac{1}{2}d.$) per mile; three times what is paid in England, or, proportionally to the different value of money in the two countries, eighteen times as much. The great reduction of time and cost of travelling resulting from a

railway, would undoubtedly increase the number very greatly; but the main question is, not how many *could* pay first class fares, but how many would *prefer* them to second class ones? If there were first class trains travelling at thirty miles an hour, at a charge of two annas (3*d.*) per mile, and second class trains at ten miles an hour, charging three pice ($\frac{3}{8}$*d.*), I believe the number travelling by the first class trains would be found to bear a very small proportion to the number going by the others.

Let us consider what would be the consequence even in England, if first class passengers were carried at 1*s.* 6*d.* a mile (which would be in due proportion to 3*d.* in this country), although the proportion of wealthy people there is at least 100 times what it is in India; and although (from the different state of things there) people so much better understand the value of time. Perhaps ninety-nine out of one hundred Natives would rather pay eight rupees (16 shillings) for travelling 400 miles at ten miles an hour, than fifty rupees (£5) for a speed of thirty miles an hour. And in order to obtain this high speed for so very small a proportion of the traffic, the whole road must be constructed at such an enormous expense, as to entail a high rate of charge for all goods and $\frac{99}{100}$ of the passengers, and a low profit to the shareholders. In this country, the loss in time, both to the great body of travellers and goods, that is, the loss arising from the difference between travelling five and forty miles an hour, is most insignificant. A ton of cotton, sugar, salt and grain is of the value of £15, £12, £8 and £3, respectively; and these would form the great bulk of the traffic. Taking the average value at £10, the interest (at 10 per cent.) in a journey of four days, (five hundred miles at five miles an hour) would be only five pice or ($\frac{5}{8}$*d.*), and the saving by going forty miles an hour would be only seven-eighths of that, say four pice (about $\frac{1}{2}$*d.*); while the difference between the cost of conveying goods on a first class railway and a cheaper one would perhaps amount to as much as from one to eight pice ($\frac{1}{8}$*d.* to 1*d.*) per ton per mile. And so with passengers; taking their time as worth fifty rupees (£5) a month, (corresponding with £360 a year in England)—and only a very small portion of the population have incomes approaching to that—three and a half days would be worth to them six rupees (12 shillings) which, saved in a journey of 500 miles, would be equal to two and a half pice ($\frac{5}{16}$*d.*) per mile.

The great difference between England and India in this respect has certainly not been considered in planning the railways. Not only is the proportion of wealthy people, whose time is of considerable value, prodigiously less in India than in England; but also the average value of goods carried is very much less here. The fact is, that while a very high speed is, in a country so wealthy and so far advanced as England, of the greatest importance, it is, in a poor country like India, entirely secondary to cheapness. It is just the same with individuals: if a poor man insists upon travelling quickly and consequently expensively, before his circumstances admit of it, he may remain a poor man all his life;

whereas, if he will but be content to economize in this as well as other things at first, he may in time be able to travel as quickly as he likes.

But even this is comparatively a very insignificant part of the question; the main point being, that in thus aiming at a very high speed at once, we are completely deluding ourselves and losing the very thing we are aiming at. The advocates for high speed say, "Let us have a thoroughly good speed *at once;*" and then they proceed to attain their end, by laying down in one corner of India a few miles of grand railroad along which you may travel for the first stage at thirty miles an hour, and then continue along the remaining 1,000 miles of your journey at three miles an hour; if indeed the monsoon permits you to move at all. At Bombay only ten miles have been laid in one year, so that ten years hence, a traveller going from thence to Calcutta might go the first 100 miles in three hours, but must take seventeen days (travelling day and night) for the remaining 1,200 miles, his average speed being only three and a quarter miles per hour.

The fact is, *the extent of the spaces for which we have to provide communications has been totally lost sight of, and, in consequence, the whole system is without a foundation;* but this no doubt is greatly owing to the system having been planned chiefly by men full of English ideas. In England, by the time fifty miles of railroad are laid in any direction from a port, it has arrived at what may be called the traffic-shed of the country, the point from which traffic moves to the opposite Coast of the island; but from Calcutta to Lahore is a distance of 1,300 miles; and even from Bombay to the centre of the Peninsula is 400 miles. In England there are 5,000 miles of railway, or about one to twelve square miles; and taking the area of India at one and a quarter millions of square miles, it would require in the same proportion 120,000 miles of railway. Even taking only one-sixth of this, there will be at least 20,000 miles of main communication required to open India; 4,000 merely to connect Lahore, Calcutta, Bombay and Madras, (without a line from Madras to Calcutta direct); so that if railroads were commenced at all four points at once, and carried on (as at Bombay) at the rate of ten miles a year, it would still take 100 years to lay these few lines, which would, after all, have but a very small effect upon the whole traffic of India. Only two of these lines are yet begun; and as to really and effectually opening India, we are in reality doing nothing: or rather, worse than nothing, since this delusion makes people imagine that they are doing what has to be done, and thus prevents them setting in earnest about the right means. If the construction of a few hundred miles of grand railroad in the course of twenty years, so blinds people as to prevent anything effectual being done to open India; it will, instead of a blessing, be the greatest curse which, in the present state of things, the country could suffer.

Supposing, however, that *speed, and nothing but speed,* were really our sole object, which would most effectually promote it? To lay down in

five years 1,000 miles of railway at Rs. 5,000 (£500) a mile; or else 170 miles at Rs. 1,20,000 (£12,000) a mile? In the latter case we might, at the end of five years, travel 170 miles in less than five hours, (at the rate of thirty-four miles an hour), and the other 830 miles in twelve days, (at the rate of only three miles an hour); whereas, in the former case, we might, at the end of the same period, travel over the whole distance (1,000 miles) in four days, at the rate of ten miles an hour. Even if our object be therefore to obtain speed alone, the first question is, *how most rapidly to throw open the country;* and for this purpose 20,000 miles of good common road to be travelled at seven miles an hour, and costing only Rs. 5,000 (£500) a mile, in all 1,000 lacks (£10,000,000), would be of immeasurably greater value than 800 miles of first class railway at Rs. 1,20,000 (£12,000) a mile, with a speed of thirty-four miles an hour: since the former could give an average speed through the country of more than double the latter. *Speed* is indeed what is most urgently wanted; but *speed in forming communications,* not *speed in travelling upon them.* If indeed it were possible to lay first class railways at the rate of 2,000 miles a year, this part of the question would be altered; but I suppose everybody will acknowledge that this cannot, or at least will not, be done; and even if it were, still 50,000 miles of cheap railway, which could be laid with the same means in the same time, would be of incalculably more value.

Nothing therefore can be more delusive than when thus carrying on a work which will take hundreds of years to accomplish, to imagine that we are really gaining our object. What is the use of going a hundred miles at the rate of thirty-four miles an hour, if we must then go on at three miles an hour over thousands of miles? Surely it is evident, that even if our only object were speed, another plan must be pursued; and how much more so, then, when speed is not our main object by any means, but cheapness is of incomparably more importance. It must be remembered that in this matter, almost all who are engaged in planning such works are liable to be under a bias; for they cannot help feeling how agreeable it would be to themselves to travel at high speed, and thus give a very undue importance to this point. Even a merchant will be very apt to think more of his own travelling quickly, than of obtaining his thousands of tons of goods at a lower price; and therefore to misjudge the relative importance of those two things. I do not mean to deny that high speed is a very desirable thing, or that it should be kept in view; but I do say, that if it be purchased for a few hundred miles, at the cost of keeping the great body of the country without improved communications for an indefinite period of years, it is manifestly purchased too dearly; and that those who are pursuing such a system, are undoubtedly defeating even their own object.

Let us now see further how this system affects the welfare of the country as regards cost of transit, and stoppage of intercourse; com-

paring it first, with common roads. The ordinary cost of transit, where there are no made roads, is, in the practicable season, from two to three annas (3*d.* to 4½*d.*) a ton per mile; with the incalculable disadvantage of traffic being almost completely stopped during three or four months of the year; and, allowing only a trifle for this latter, we may fairly reckon the average cost of transit at three annas (4½*d.*). Of the effect of good common roads in cheapening transit, we have proofs in different parts of the country; for instance, on the grand Trunk road of Bengal, the cost of transit has been reduced to eight pice (1*d.*) per ton per mile, and on the great western road from Madras, it is even now little more than one anna (1½*d.*); but the latter is not yet by any means in complete order, and the price will undoubtedly fall still lower. From these examples we may take the average cost of transit on a thoroughly good common road, at nine pice (1⅛*d.*) or one-fourth of the present cost; showing a saving of two and a quarter annas (about 3¼*d.*) per ton per mile; and as regards the cost of such a road, the grand Trunk road in Bengal having cost about Rs. 8,000 (£800) a mile, the western road from Madras (a badly planned road) about Rs. 7,000 (£700), and others in Madras from Rs. 3,000 to Rs. 4,000 (£300 to £400) a mile, we may therefore take the average cost throughout the country generally at about Rs. 5,000 (£500) per mile, the grand Trunk road being a wider and more complete work than would be necessary in general. And, on the other hand, the average cost of a mile of first class railroad may be taken at Rs. 1,20,000 (£12,000), a sum that would make twenty-four miles of first class common road.

The cost of working complete railroads seems to be strangely estimated for in this country. Mr. Chapman hopes they may be worked at 2¾*d.* a ton (including interest), or two and a half times as much as good common roads are now worked at; a strange sort of improvement by the way, and perhaps scarcely worth paying Rs. 1,20,000 (£12,000) a mile for. In England, the actual cost of working at considerable speed is ⅕*d.*, or one and three-eighths of a pie a ton; but in this country it would certainly be less; suppose one pie or ⅛*d.* To this must be added the cost of management, which, in this country, however, will be very moderate; but still the whole cost (inclusive of interest) will probably be four pice (½*d.*) per ton per mile; it cannot be very much less, and the railway men estimate it much higher. Calculating then the comparative effects on the country of Rs. 1,20,000 (£12,000) spent either on one mile of railway, or on twenty-four miles of common road, with a traffic of about 200 tons a day, and taking interest at 10 per cent., we have the following results:—

Present Cost of Transit on existing common unmade Road.

60,000 tons twenty-four miles at three annas (4½*d.*)	Rs. 2,70,000	(£ 27,000)

Present Cost of Transit on good common-made Road.

60,000 tons twenty-four miles at nine pice ($1\frac{1}{8}d.$)	Rs.	68,000	(£ 6,800)
10 per cent. on Rs. 1,20,000 (£12,000) (the cost of the road).	,,	12,000	(£ 1,200)
	,,	80,000	(£ 8,000)
Repairs and management at Rs. 500 (£50) a mile (24 miles)	,,	12,000	(£ 1,200)
Total cost on twenty-four miles good common-made road	Rs.	92,000	(£ 9,200)
Annual saving on twenty-four miles by a good road.	Rs.	1,78,000	(£ 17,800)

Cost of Transit on one mile of Railway, and twenty-three of unmade Road.

60,000 tons one mile at four pice ($\frac{1}{2}d.$)..	Rs.	1,250	(£ 125)
60,000 tons twenty-three miles at three annas ($4\frac{1}{2}d.$)	,,	2,58,750	(£ 25,875)
10 per cent. on Rs. 1,20,000 cost of railway (£12,000)	,,	12,000	(£ 1,200)
Total cost of one mile of railway, and twenty-three of unmade road.	Rs.	2,72,000	(£ 27,200)
Annual loss by railway compared with present unmade road.	Rs.	2,000	(£ 200)
Annual loss by railway compared with good common road	Rs.	1,80,000	(£ 18,000)

This is only a fair representation of the different effects on the country, as regards most of the main lines, of spending Rs. 1,20,000 (£12,000) on one mile of railway, or on twenty-four miles of common road; and to counter-balance this enormous loss, we have the following difference in speed. Of course, there is no reason why a common road should not be worked constantly by relays of bullocks in the same way as a railway is worked continuously; and, if worked day and night by relays, we might have a speed of at least fifty miles a day for goods, and for passengers eight miles an hour, or 200 miles a day. By the railway, on the other hand, goods would be carried at the rate of 400 instead of fifty miles a day, thus saving nine days in a journey of 500 miles; and the saving in time to first class passengers would be about one and a half days for the same length of journey; but, as before stated, the value of the great mass of goods is so low, and the proportion of travellers in this country, to whom time is any great object, is, and will for some years to come, be so exceedingly small, that this cannot be considered a point of any great import-

ance. Now the question is, whether this speed be worth purchasing at the enormous cost of about Rs. 8,000 (£800) a mile per annum, where there is a traffic of 200 tons a day; or, on the 20,000 miles of main road supposed to be required in India, a cost of 1,600 lacks, or sixteen millions sterling a year. Can any body who knows any thing of India, or indeed of the subject of communications generally, doubt for a moment which would be most beneficial? 800 miles of railway, or 20,000 miles of common road? The same Capital that would suffice for the one would serve for the other, and who can question which would be preferable to do at *present*, whatever might be done *ultimately?*

Having thus considered the matter with reference to the benefits to the country, we may next examine it in regard to the investment of Capital. Let us suppose a Company with a Capital of one million sterling, with which they may form in five years, either eighty miles of high speed railway, or 2,000 miles of common road, and compare the respective cost:

60,000 tons conveyed 2,000 miles on present roads at three annas ($4\frac{1}{2}d.$) per ton per mile.	225 lacks	(£2,250,000)
Do. do. same distance on good common road at eight pice ($1d.$) per ton per mile. . .	50 ,,	(£ 500,000)
Saving by good-road . . .	175 lacks	(£1,750,000)

If only one-fourth (about forty-three lacks) (£430,000) were taken as toll, leaving three-fourths (132 lacks) (£1,320,000) clear benefit to the community, this would still give the shareholders 43 per cent. on their Capital; and the community would further have the immense advantage of a regularly organized system of conveyance by a Company; goods being carried fifty, and first class passengers 200 miles a day, instead of ten and seventy miles respectively, as at present.

With eighty miles of railway, the comparative results would be as follows:—

60,000 tons conveyed eighty miles by rail at four pice ($\frac{1}{2}d.$) per ton per mile	1 lack	(£10,000)
Do. do. same distance on present roads at three annas ($4\frac{1}{2}d.$) per ton per mile	9 lacks	(£90,000)
Saving by railway . . .	8 lacks	(£80,000)

If one-fourth of this (two lacks) (£20,000) were taken as profit, the return on the capital (100 lacks) (one million sterling), would be two per cent.; and the saving in transit to the community, six lacks (£60,000).

Or, the comparative results of the investment on the two works, would be as follows :—

Profit to shareholders on 100 lacks (1 million sterling) expended on eighty miles of railway............................	2 lacks	(£ 20,000)
	or 2 per cent.	
Profit on same sum spent on 2,000 miles of good road..................................	43 lacks	(£ 430,000)
	or 43 per cent.	
Annual saving to people by railway.......	6 lacks	(£ 60,000)
Do. do. by good road....	132 ,,	(£1,320,000)
Greater saving by good road...............	126 lacks	(£1,260,000)

Such would be the result so far as goods are concerned, and the number of first class travellers is at present so utterly insignificant, as clearly to show, that unless the rates be greatly lowered, very few indeed of that class will travel by railway. There will be a vast number of other passengers if carried at very low rates, but certainly not otherwise. Perhaps the payments from passengers might be,

50—1st class a day (15,000 a year) at two annas (3*d.*) per head per mile	Rs.	1,875	(£ $187\frac{1}{2}$)
200—2nd class (60,000 a year) at half an anna ($\frac{3}{4}$*d.*)	,,	1,875	(£ $187\frac{1}{2}$)
2,000—3rd class (600,000 a year) at two pice ($\frac{1}{4}$*d.*)	,,	6,250	(£ 625)
Gross receipts per mile...	Rs.	10,000	(£1,000)

It must be observed, that these rates (1st class 3*d.*, 2nd class $\frac{3}{4}$*d.*, and 3rd class $\frac{1}{4}$*d.*) are equivalent respectively to 18*d.*, $4\frac{1}{2}$*d.*, and $1\frac{1}{2}$*d.* in England; which supposes a proportionally much higher rate of charge, in a much poorer country. And yet the profit from even this would not be great; for if the cost of transit amounted to one-half (Rs. 5,000 (£500) a mile), there would only remain the other half, or 5 per cent., as profit on passengers; but I will not go further here, because this is enough to show that the profits could never approach to those on the same money invested in common roads. Even if the whole of the money paid by passengers on a railway could be taken as profit to the shareholders, it would still be trifling compared with that on a common road, as has, I think, been clearly shown; and thus the return of Capital invested on first class railways, as compared with that laid out on common road, cannot stand five minutes' calculation.

We now proceed to compare a very cheap railway with a first class one. A cheap railway—with a gauge of three or four feet, light rails, without sleepers, sharp curves, considerable gradients, and timber via-

ducts,—fit for working at very low speeds, by horses and bullocks, or with light engines, may be constructed throughout India generally for Rs. 6,000 (£600) a mile, and could probably be worked at two pice ($\frac{1}{4}d.$) a ton per mile, or one-fourth the cost of working a first rate common road. Mr. Chapman indeed, in his book, estimates the cost of working such a road at three annas ($4\frac{1}{2}d.$) per ton per mile; but I suppose few readers would require me to confute, step by step, several pages of argument which end in the conclusion, that a cattle railroad cannot be worked under three annas ($4\frac{1}{2}d.$), or four times the cost at which the grand Trunk common road is now actually worked. We cannot be far wrong in estimating the actual cost at one-fourth of that of the best common road.

Supposing therefore one million sterling to be expended on 1,700 miles of such cheap railway, then the saving of cost in conveyance by it, as compared with a high speed railway, would be as follows :—

60,000 tons conveyed 1,700 miles at three annas ($4\frac{1}{2}d.$) per ton...........	192	lacks	(£1,920,000)
Do. do. same distance by cheap railway at two pice ($\frac{1}{4}d.$).............	11	„	(£ 110,000)
Annual saving by cheap railway........	181	lacks	(£1,810,000)

If one-fourth of this (forty-five lacks) (£450,000) were taken as profit to the shareholders, it would give 45 per cent., and the community would have a clear gain of 136 lacks (£1,360,000) a year, against (as shown above) a profit by the high speed railway of only two per cent. to the shareholders, and of six lacks (£60,000) to the community, on the same Capital (one million sterling).

In the same way, this sum might be expended in greatly improving 10,000 miles of river navigation (if we had so much capable of improvement) at the cost of Rs. 1,000 (£100) a mile, which would perhaps reduce the cost of transit, where the rivers are already navigated, by one pie ($\frac{1}{8}d.$) a ton; and this, on the Ganges, for instance, where the traffic is estimated at two million tons, would amount to Rs. 10,000 (£1,000) per mile, or 1,000 per cent. on the outlay. Or, if the same Capital were expended in making navigable a river not at present available (as the Godavery), it would create an immense traffic at one or two pice ($\frac{1}{8}d.$ or $\frac{1}{4}d.$) per ton, in a tract of country where there is at present scarcely any traffic, and where the cost of transit is about three annas ($4\frac{1}{2}d.$) per ton. Again, it might be laid out in establishing (by means of weirs) perfect steam navigation on the Ganges for an extent of 1,200 miles, at a cost of Rs. 8,000 (£800) a mile, thus reducing the cost of transit of a ton of goods from four pice to half a pie ($\frac{1}{2}d.$ to $\frac{1}{16}d.$) and saving three and a half pice per ton; which, on an average of one and a quarter

million of tons for the whole distance, would be a saving of Rs. 22,000 (£2,200) a mile, or 350 per cent.

These rough calculations show undoubtedly, that whether our object be the improvement of the country, or the profitable investment of Capital, there can be no shadow of question that what is most wanted at present, is *a system of works that will materially reduce the cost of transit over a large extent of country,* rather than one requiring a large expenditure for a very small extent of communication, however perfect that small extent might be made. I am certain it cannot require five minutes' consideration, to show to any person, who is willing to learn the real state of the case, that to expend on communications of any kind, so large a sum as a lack of rupees (£10,000) per mile, or even one-fourth of that sum, is a complete mistake. If it be said, that in these calculations no account is taken of the passenger traffic, I answer, "because that does not materially affect the question." If goods can be carried cheaply at low speeds, travellers can also; and the number who could afford to pay high for a speed above 150 miles a day, is so insignificant as not to stand a moment's comparison with the benefits of *cheap* carriage. And further, by cheap communications, higher rates of speed will, on the whole, be obtained; for a man will pass quicker over a distance of 2,000 miles by means of a low speed railway alone, than by means of eighty miles of high speed railway, and 1,920 of unmade road.

There are certainly not less than 5,000 miles of river navigation that can be made very good, so as to be worked at two pice ($\frac{1}{4}d.$) per ton per mile; and for this, a Capital of only fifty lacks (half a million sterling) would be required. If any one thinks that it would be either more profitable to shareholders, or more beneficial to the community, to have fifty miles of high speed railroad for the same money, he must have a mode of coming to that conclusion, different from any I am acquainted with.

But let us now suppose that besides 5,000 miles of river transit, we require (as I have said) 15,000 miles of main line of land communications, what will be the result of refusing to have anything but complete railroads on those lines? Even if carried on in all the four Presidencies at once, at the rate of fifty miles a year, (of which, however, there is little enough prospect at present), it will take seventy-five years to complete the whole. In all probability, the greater part of these lines would, in fact, continue bare tracks for ever; but if they were made railways, the consequences would be something like this. If the present average tonnage on all these lines be equal to 100 tons a day, or 36,000 tons a year, the cost of traffic may be taken at Rs. 7,000 (£700) a mile, or 1,050 lacks (£10,500,000) a year. If the cost of transit were reduced to one-fourth on the railroads, then, as far as the rails extended, it would be Rs. 1,750 (£175) a mile, and on the rest, it would continue at Rs. 7,000 (£700) a

mile. On the average of the seventy-five years, half would be worked at the former, and half at the latter rate; and the total cost would then be—

15,000 miles at one lack (£10,000) per mile	15,000 lacks	(150 millions sterling)
7,500 miles worked for seventy-five years at Rs. 1,750 (£175) per mile.	10,000 ,,	(100 ,, ,,)
7,500 miles worked for seventy-five years at Rs. 7,000 (£700) per mile.	40,000 ,,	(400 ,, ,,)
Total ...	65,000 lacks	(650 millions sterling)

And the comparative cost on the proposed cheap railways to be completed in fifteen years, would be—

15,000 miles at Rs. 6,000 (£600) per mile	900 lacks	(9 millions sterling)
7,500 miles worked for fifteen years at Rs. 1,750 (£175)	2,000 ,,	(20 ,, ,,)
7,500 miles for fifteen years at Rs. 7,000 (£700)	8,000 ,,	(80 ,, ,,)
15,000 miles for sixty years at Rs. 1,750 (£175)	15,750 ,,	(157½ ,, ,,)
Total ...	26,650 lacks	(266½ millions sterling)
Total for complete railway (as above)	65,000 ,,	(650 ,, ,,)
Saving by cheap railway	38,350 lacks	(383½ millions sterling)

or about five millions sterling annually, for the seventy-five years, exclusive of all that would be saved by the increase of trade, and all the effects of the passenger traffic.

In point of fact, every 100 miles costs the country in transit at least ten lacks of rupees (£100,000) for every year that the country is kept deprived of improved communications; and, supposing the traffic to be (exclusive of passengers) on the average 100 tons a day, (an estimate which is far exceeded on many lines), then, on the whole 15,000 miles, the loss to the country may be estimated at about 1,500 lacks, or fifteen millions sterling a year.

It is particularly to be observed, that, as respects the main point, viz., *time of completing a system of communications*, cheap railways have an enormous advantage over common roads; and, as regards outlay, the former would cost little more than the latter, while five-sixths of their cost would be for iron, &c., which would be brought from England, and obtained just as fast as wanted. The preparation of a line of country for the rails, with a narrow gauge, would cost perhaps one-fifth of the outlay for a good road; and could therefore be done in about a-fifth of

the time. No doubt Rs. 1,000 (£100) a mile would be sufficient to prepare the line for the rail, and hence 100 miles a year might, with the greatest ease, be laid down in every district, expending only one lack (£10,000) a year on the spot. At the Godavery works in the Rajahmundry District, from two to four lacks (£20,000 to £40,000) a year have been spent; and allowing time for the purchase of materials for bridges, it would only require 3,000 men for ten months to prepare 100 miles for the rails.

Thus the time saved in laying such a railway, as compared with making a road, would, on all main lines, much more than pay for the railway; and this shows in a striking manner the mistake of going on with common roads on main lines. On the great lines, for instance, those entering Madras, where Rs. 30,000 (£3,000) a year are now spent on transit, the whole cost of such a railway would be saved in three months; and if it took five years to make a certain length of common road, instead of one year to lay a railway, the cost of the latter would be saved twenty times over in the time the former would require for its execution.

We have thus shown that there are lines where, independently of the saving in working the railways when laid, it would be as cheap to construct railways at Rs. 30,000 (£3,000) per mile in one year, as to make a common road in two years at Rs. 5,000 (£500) per mile; or, if one kind of railway could be laid in two years, at a cost of Rs. 6,000 (£600) per mile, it would still be worth while (if necessary) to pay Rs. 30,000 (£3,000) per mile for another kind of railway, which, by entailing less labour in preparing the line, would be capable of completion in one year. So important and pressing is the subject of opening lines of cheap communication in India, that we feel safe in saying, that there is a loss of two millions sterling to the country, for every month that the general opening of India is delayed. If a railway were made, entirely composed of wrought iron beams supported on cast iron screw piles of different lengths, so as to render unnecessary all work in the ground, beyond screwing in the piles, and fixing the beams, it would, in consequence of the great saving of time, be the cheapest communication that could be executed, even though it cost five times as much as a common road or another kind of railway that took longer to complete. Thus, in continuing to make common roads instead of cheap railways, we not only incur a cost of transit five times as great, but also a much greater first cost, taking into account not only the actual expenditure, but also the loss in cost of transit incurred by the country during the time of construction; and, in making high speed railways, there is added thereto the loss in the additional cost of construction. If a railway, costing Rs. 80,000 (£8,000) a mile, be laid over 100 miles in five years, and one composed of beams and screw piles, and costing Rs. 20,000 (£2,000) per mile, were laid over the same extent in one month, both on lines where Rs. 30,000 (£3,000) a year are at present

paid for transit; then, the accounts at the end of five years would stand thus:—

High Speed Railway.

Cost of 100 miles at Rs. 80,000 (£8,000)....	80 lacks	(£ 800,000)
Working half of the 100 miles for five years at Rs. 30,000 (£3,000) a mile.......	75 ,,	(£ 750,000)
Working the other half, same time, at four pice ($\frac{1}{2}d.$) per ton, or one-ninth of present rate..........................	8 ,,	(£ 80,000)
Total expenditure...	163 lacks	(£ 1,630,000)

Cheap Railway.

Cost of 100 miles at Rs. 20,000 (£ 2,000)	20 lacks	(£ 200,000)
Working do. for five years at two pice ($\frac{1}{4}d.$) or one-eighteenth of present rate..........	4 ,,	(£ 40,000)
Total on cheap railway	24 lacks	(£ 240,000)
Total on high speed railway	163 ,,	(£ 1,630,000)
Saving by cheap railway...	139 lacks	(£ 1,390,000)

The difference in the cost of working the two railways, (allowing for interest on the additional Capital of Rs. 60,000 (£6,000) per mile, required for the high speed railway) would then be eight pice (1*d.*) per ton per mile, on a traffic of 160,000 tons a year.

From this, it appears, that the high speed railway would, in a year, actually cost six times as much as the cheap railway; and the cost of transit would be permanently more than doubled, even though interest be only allowed at 4 per cent.; and if a larger profit were allowed, the difference would of course be much greater.

No wonder, however, that false conclusions have been universally reached, when the chief element in the question, viz., *the annual loss on the different lines by the present defective means of transit*, has been left out of the calculation.

I have before said that I do not think lightly of the value of high speed railroads; on the contrary, I think them of incalculable value, and would have them in every country as soon as possible. I would have the transit from Cape Comorin to Peshawar, 2,000 miles, accomplished in forty hours if I could; but if, as at present, that were only worth to the community, suppose £100,000 a year, while the same time and money would give us what was worth twenty millions a year, even though there were not a mile of communication in all India along which we could travel at the rate of twenty miles an hour, I should think we had made a fool's bargain by preferring the former to the latter. I trust indeed that the time is not far distant, when there will be quick as well as cheap travelling through-

out India; but I am sure that the way to accomplish this is not the one hitherto pursued, which may indeed give us a few hundred miles of quick transit in the course of years, but cannot possibly give us an *even speed* throughout the country; and, even if it could, we should still have to set about providing ourselves with what is of immeasurably more importance, *cheap* transit. If we were presented with a complete system of high speed railways, embracing all India, "*at once*," we should still be just where we are with respect to the main point, *viz.*, the conveyance of the great mass of passengers and goods. It was very excusable in the original projectors of the Manchester and Liverpool Railway to plan it for the carriage of goods, as a competitor or substitute for the canals, and not surprising, that a suggestion to use it for travelling, should have been received with a general laugh by the Committee, because they had not then actually tried such a means. But for us to start upon this idea, after it has been proved by a twenty years' trial that the projectors were totally mistaken, and after the actual result has been, that the canals, although worked at only two miles an hour and without steam-power, continue to carry two million tons of goods, while the railway carries the travellers and a small portion only of the more valuable goods (not one-twelfth of the whole)—for us to set about the opening of an entirely new country under the influence of the same ideas held twenty years ago, as though we had no such an example before us, is indeed a most strange infatuation. The high speed railways in England do not, and never can, carry the great mass of the goods traffic of England, small as it is compared with what there would be in an immense country like India; and even if they could, it would only be at a cost at least four times as great, as the same traffic could be carried by steam canals.

Nothing can be more certain than that these railways will not accomplish that for which they were intended, even on the great lines of communication; that is, to convey the whole of the passengers and goods requiring carriage on those lines. They cannot convey the whole at any cost, much less at the small cost that is absolutely necessary; and therefore we have still to consider the whole subject from its foundations, just as if nothing had yet been said or done.

Imagine the manufacturers of Manchester, and the merchants of Liverpool, deprived of their water communications, *wretched as these are*, and left to the mercy of the railway to carry all their passengers, and at the same time their 2,200,000 tons of goods; and, suppose that without a competitor, the railway could carry perhaps at the utmost, one-fifth part, at its own price. Who cannot see, *that Manchester could not exist under these circumstances?* And yet this is exactly what is now proposed as the grand remedy for all the evils of India.

WATER.

Water of India more valuable than Gold of Australia.

THE savages of Australia trod upon gold for hundreds of years, while they were often in want of food, and always without a rag of clothing. Very similar has hitherto been the state of things in India: with an unlimited supply of water within reach, which would more than provide for every possible want, the people of India have been generally barely supplied with the necessaries of life, and often so entirely without them as to perish by hundreds of thousands; whilst their European rulers, though possessed of this treasure, of far greater value in proportion to the cost of obtaining it than the richest gold mine in the world, have been unable to make their income equal their expenditure.

It seems as if in India, men had universally jumped to the conclusion, that because water is immensely *valuable*, it must therefore be immensely *costly*, without stopping to calculate what its cost really is. A person in India, in the midst of the hot season, naturally forms in his mind an idea of the immense value of water; and it does not readily occur to him, that what is so valuable may at the same time be the cheapest thing in the world; just as it was at Port Phillip, where the last thing that men were inclined to suppose, was that many tons of so valuable a thing as gold, should be under their feet.

Our present question then is, What is the comparative *value* and *cost* of water in India? We will not stop now to enquire its value for drinking; that is of course inestimable, and the same in so far as it is required to prevent famine; but we must content ourselves here with a calculation of its value for those purposes which come within reach of a money valuation.

These purposes are 1st, Irrigation; 2nd, Navigation.

Irrigation.

Water may be used in three ways for irrigation:—

1st. For the complete irrigation of a crop which requires to be constantly and abundantly supplied, beyond what the ordinary monsoons afford.

2nd. To enable us to grow, at seasons when no rain at all can be expected, things that require only a trifling quantity of water.

3rd. As in the case of sugar, to enable us to grow what requires so long a time to nurture, that the monsoon is not of sufficient duration.

The first kind of irrigation is, in this part of the country, chiefly applicable to rice, of which there are innumerable kinds, requiring from four to six months to nurture; but, as it is usually in the seedbeds for the first month, and needs no water for the last month or six weeks, water is required only during the intervening period of from two to four months; excepting indeed a small quantity for the seedbeds, which are only one-thirtieth part of the extent of the transplanted crops. As regards rice grown in the height of the hot season, the evaporation in the Madras Presidency, generally being nearly half an inch a day, it follows, that about seventy cubic yards a day would be evaporated from an acre of rice land if fully exposed to the action of the wind. From experience this does in fact seem to be about the extreme quantity required for rice, and the average required during the whole crop, appears to be considerably under this, even in the hot season. Supposing a six months' crop; then, at the rate of seventy cubic yards a day, an acre of rice land would require for a four months' supply, 8,400 cubic yards. It never actually consumes this quantity, it is true; but it is very important that the water should occasionally be changed; and allowing for this and for great waste, we commonly reckon 7,500 cubic yards as the extreme quantity required for an acre. The four months' crop of course requires less, only about 4,000 cubic yards; but it is proportionably less valuable. If grown in the monsoon, a large proportion is of course supplied by the rains; for instance, if thirty inches of rain fall, this is equal to 4,000 cubic yards per acre; but much of this is lost, because it falls in too large quantities at a time, and therefore runs off to waste. Supposing therefore only one-half of this quantity (2,000 cubic yards) to remain available, then, reckoning 7,500 cubic yards per acre, there will remain 5,500 cubic yards to be supplied artificially, for a six months' crop; or, we may allow on an average, 5,000 cubic yards per acre for the four and six months' crops grown during the monsoon, and 7,000 for those raised in the hot season.

The value of an acre of rice land must vary very much, according to the nature of the soil and the market price of rice; but in the Madras Presidency, where the average weight of produce is about 1,200 lbs., we may take the average value at fifteen rupees (£1 10*s.*) per acre.

The produce of unirrigated land is of course much more variable, on account of the precarious nature of the rains, a large portion of the crop being constantly lost either from excess or deficiency of moisture; but we may take the average value of dry crops grown in the rainy season, at six rupees (12*s.*) per acre, leaving nine rupees (18*s.*) as the difference due to irrigation. The additional expenses of rice cultivation above that of dry cultivation, are not easily averaged, because they consist partly of the interest of money invested in the preparation of the land, and partly in the transplanting, &c., but we may at least safely allow an increase of six rupees (12*s.*) per acre, as due solely to the water, which gives 5,000

cubic yards for six rupees (12*s.*) or 800 cubic yards for one rupee (2*s.*). In the hot season more water is consumed, but the crop is proportionably more valuable; and if we allow water for rice to be worth one rupee (2*s.*) per 1,000 cubic yards *when so used*, we shall certainly not overvalue it, at least as regards this part of India.

The second way in which water may be used, is for the cultivation of what we call dry grains, in the dry season. For this purpose, very little water is required; sometimes little more than the moistening of the soil at first, to enable the ryots to plough, and to make the seed germinate. One of the principal dry grains, cholum, cannot bear heavy rains at all after it is one or two feet high, so that if rain continues two or three days, the whole crop rots as it stands, which frequently happens; but often it does not get a drop of rain after it is a foot high, and then there is an abundant harvest. One of the great uses of having water at command is, to enable the ryot to grow his grains at whatever season he pleases, and thus secure a good crop; for instance, if the cholum crop could be sown after the heavy rains are entirely over, it would never be lost, and the very little water required for it would easily be provided. Again, in the height of the hot season, when the agricultural population is scarcely at all employed to any good purpose, a very small quantity of water is sufficient to enable them to grow a crop of some dry grain. Tens of thousands of acres in the delta of the Godavery (where nobody until lately thought of attempting to grow anything in the hot season) are now, in consequence of a supply of water being at command, covered with crops of oil-seeds and other things; for with these crops, a first watering of about four inches, or 500 cubic yards per acre, with perhaps as much more during the growth of the crop, secures the harvest. Then, the difference between the cost of cultivation, and the selling price of the produce, is the value of 1,000 cubic yards of water; this of course varies greatly, but reckoning it at three rupees (6*s.*), we find that water is worth, in the hot weather, about one rupee (2*s.*) per 300 cubic yards.

The third kind of irrigation applies chiefly to the cultivation of sugar, chillies, &c., which require water for a greater length of time than the monsoon lasts. Sugar is of course a thing of first importance. In the Presidency of Madras it is a ten or eleven months' crop, requires water until within a month of being cut, and consumes a very large quantity. In the height of the hot weather, when quite young and only two or three feet high, it takes seventy cubic yards a day per acre; during the monsoon, when ten or twelve feet high, it probably consumes much more; and in the cold season, when approaching to ripeness, it will take up three or four inches of water in a few hours. We may therefore reckon, that sugar requires on an average, (in addition to what it gets from the rains), fifty cubic yards per acre for 300 days, or 15,000 cubic yards in all. The value of the crop in highly cultivated rich land, may be taken at Rs. 120 (£12) an acre, and the cost of cultivation (including land-tax) at

seventy rupees (£7), leaving fifty rupees (£5) as the value of the water, or one rupee (2*s.*) per 300 cubic yards. In the delta of the Godavery, water for this purpose used to be raised from the river or from wells, at a cost of about 500 cubic yards per rupee, or thirty rupees (£3) per acre, leaving twenty rupees (£2) as the profit; but the price at which water is now extensively purchased for irrigation, is of course an unanswerable proof, that it is worth more than that. Millions of cubic yards of water are purchased annually in the Madras Presidency, at prices varying from 1,000 to 300 cubic yards per rupee (2*s.*), (the cost of raising it from wells and rivers, exclusive of the interest of the cost of the well and apparatus), which is the most clear and certain proof of the value of water.

It is not necessary here to attempt to estimate the value of water for innumerable other products, such as plantains, cocoanuts, betel, &c.; but I think we are quite safe in reckoning its value for irrigation even in ordinary seasons in the Madras Presidency generally, at one rupee (2*s.*) per 500 cubic yards. Of the value of water stored up in seasons when the local rains fail, who can form any judgment? If 1,000 cubic yards would secure the crop on an acre of cholum, thus providing 1,000 lbs. of food, more than sufficient to feed two individuals for twelve months, and in time of scarcity to preserve the lives of perhaps a dozen, till rain falls, then every 100 cubic yards of water may be the means of saving the life of one person.

Thus in different ways we attain to a certainty, that water when applied to the land, is worth (even in ordinary seasons) at least one rupee (2*s.*) per 500 cubic yards; and as every square mile of land in India receives from the rains on an average, probably at least three-fourths of a yard more water than is consumed in evaporation, the rains supply two million cubic yards to be stored for use, which, at the above rate, (500 cubic yards for one rupee) (2*s.*) would be worth Rs. 4,000 (£400) per annum.

It may be well to add some remarks on the present state of irrigation in the Madras Presidency, both in order to show what has already been done, and also in order to meet some of the principal objections continually urged against this fundamental means of improvement, though refuted a hundred times.

The extent of irrigated land in Madras is given at two and a quarter millions of acres, (exclusive of a considerable quantity of free and zemindary lands) which (including the two crop lands) may probably produce on an average 2,000 lbs. of rice per acre; and this, at the rate of one and a half pound per head per day, would supply food for about eight millions of people, (rather more than a third of the population of the Presidency); the food for the remaining two-thirds, and all other agricultural produce, such as cotton, oil-seeds, gram, &c., being grown on *un*irrigated lands.

A considerable portion of the irrigated land, however, is dependent for water on tanks filled solely by the local rains, which, being very uncertain, it follows that the supply of a proportion of the above quantity of food (for one-third of the population) is at all times precarious, and in bad seasons often lost. The rest of the irrigated land, amounting to perhaps one-half, is supplied either from large rivers or tanks, which never fail. Part also of the dry cultivation (*un*irrigated land) is situated where the local rains have never been known to fail; but other parts again are liable to entire failures of the monsoon.

It will thus be seen how very far we yet are from having such an extent of certain irrigation as will secure a full supply of food for the whole population, which alone appears to me in itself an ample answer to those who, from a secret dislike of all improvement, are continually expressing their dread of extending irrigation.

A great portion of the present irrigation also requires to be ensured by the addition of two classes of works:—

1st. Channels leading from large rivers, which, rising in the western ghauts, never fail, and have a continuous supply for some months.

2nd. Very large tanks to be filled by the flood waters of the rivers, and thus store up a supply of water for the summer rice, in those months when there would otherwise be an insufficient quantity.

Besides thus securing a never-failing supply of water to the land at present irrigated, we may, by the employment of the same means on an extended scale, water almost any extent of new land. This has reference so far to the prevention of actual famine, by securing a supply of food to the whole population; but the next point is, by growing food from irrigated rather than dry land, to procure it at a less cost.

One of the most extraordinary ideas on the subject of irrigation is, that by means of it, *too much food* will be grown, and thus entail many fancied evils. It seems strange that such ideas should be entertained; but so it is, and they are constantly being repeated and brought forward. I reply, that nobody wants to carry irrigation to such an extent that more food shall be grown than can be consumed; nor indeed is that possible, for no one can imagine, that people will go on growing grain for which there are no purchasers: the moment men find there is no profit in growing grain, they will turn to something else. We may just as well be afraid, that the country will some day be ruined in consequence of too many ploughs being made. All we want to do is, first, to try and place the supply of food beyond the reach of the bad seasons to which the country is ordinarily liable; and, secondly, to secure that food with as little labour as possible. Probably two-thirds of the food of the country is at present grown on dry land, which, even in the most favourable seasons, requires, in order to produce a certain quantity of food, three or four times as much labour as irrigated land. Does it not seem wonderful then, that any one should imagine that the country

or the treasury will be impoverished, by enabling the people to grow food by a less expensive means, even when the produce is also less precarious. We need have no fear of extending irrigation too far, not only while two-thirds of the people are fed by grain grown on dry lands, but also so long as one single acre of land remains unirrigated.

It may seem absurd to occupy time in repeating such arguments; but it is too certain that even intelligent men are often carried away by these fancies for want of opportunities of enquiring into the subject.

Another form in which the objections to irrigation are put is, "What is the use of growing more food than can be consumed on the spot, unless there be communications to provide for its being taken to other markets."* First it may be remarked, that the very persons who object to extended irrigation when that is proposed, most readily find a reason for objecting to extension of communications when that is proposed; and, secondly, the substitution of irrigated for dry cultivation has nothing whatever to do with communications. The two things are perfectly distinct, so that the argument for extended irrigation is equally applicable to a country *without* communications, as to one *with* them.

Let us suppose ten men wrecked on an island, and that at first nine of them are constantly employed in procuring food for the whole number; but that after many discussions, one succeeds in persuading them, that it would be best to employ their spare tenth day in cutting a channel, which would enable them to grow food with one-half of the labour they did before; so that from this time forward, instead of living in the most comfortless way, with a bare subsistence, they have five men available to build houses, and do all sorts of things conducive to health and comfort. It will surely be admitted by all, that this is quite independent of communications either in their own island, or with other lands; and we may surely suppose, that our Islanders are not so senseless as to go on employing nine of their party in growing food, after discovering a way of growing enough to feed the whole number, by the labour of only five. Having accomplished this, they will surely next lay the foundation of many kinds of improvement, setting apart a time for study, &c., &c., and employing some of their party in making internal communications, or building a boat to trade with other islands, and so on. If by communications with another island, they can obtain some article more easily than in their own, it will of course be a further advantage; but this is entirely distinct from *raising food in the easiest manner.*

Again, it is said, that food, if plentiful, is cheaper, and low prices endanger the Revenue; but this is as much as to say, that a district containing a million of people, out of whom 800,000 are employed in growing food for the whole on dry land, will be better able to pay certain Revenues, than if only 400,000 could grow the same quantity on irrigated

* Even Mr. Chapman does not hesitate to say that it is perfectly useless extending irrigation unless communications were made at the same time.

land. How should it be possible, that compelling the people to grow food in a more laborious manner, should make them better able to pay the Revenue?

The only way in which men can arrive at such untenable conclusions, seems to be this:—

When food is scarce, it is dear.

When food is dear, the cultivator can easily pay his tax;

Therefore when food is scarce, the Revenue is easily paid.

Who cannot see where the fallacy lies in this case? The man who has *grain to sell*, is of course the better for high prices; but high prices exist only because there are *few* who have grain to sell, and consequently high prices imply an impoverished state of the community *upon the whole*, and less ability to pay the Revenue. Who cannot see that the same reasoning which tends to prove that irrigation should be restricted, equally tends to show that there should be no irrigation at all; and much more than this, that all ploughs even should be destroyed? Irrigation is nothing but a means of growing food cheaper, that is, with less labour; and ploughs and bullocks are exactly similar. If it be to our advantage to grow grain with a greater amount of labour, by adhering to dry cultivation, it must be still more advantageous to prohibit ploughs, and when they are gone, to prevent the people from using hoes, or even pointed sticks, to turn up the soil: for these inferior means of facilitating labour are exactly the same in principle as the Ganges canals. What an astonishing proof of the wide difference still existing between the ideas of old Indians and of real Englishmen, that it should be necessary to say, much more to put on paper, such things as these!

Then again, it is said, that grain has at times fallen so low in price as to be almost unsaleable. In reply, we may observe, in the first place, that if a country be so well supplied, that in no year, however bad, will the food be greatly deficient, there must certainly be some years when it will be superabundant, and prices will consequently fall even disproportionately low, especially among a people who, having no Capital, cannot afford to keep some of their grain for another year. But which of the two is best? To have occasional temporary inconvenience from low prices, or to have real impoverishment and misery from deficiency of grain, even though the few who have grain for sale, may get high prices? And as to supposing that people will continue to grow more food than they can consume or sell, one would imagine it impossible that such a fancy could be entertained. The correct mode of reasoning appears to be this:—

Food is grown with less labour on irrigated, than on dry land.

The less labour is required for growing food, the more remains for all the comforts and conveniences of life;

Therefore the whole food of the community should be grown on irrigated, rather than on dry land.

There is such strange confusion of ideas on this subject, apparent in innumerable books and papers, that it seems very necessary to make one more attempt to place the matter in a clear light. The question of facilitating the growth of food by irrigation, is perfectly distinct from that of communications, though it is true, at the same time, that the full benefits of irrigation cannot be realised without communications; whereas, if there be cheap transit, the people of a tract of country, possessing peculiar water advantages, will not only grow their own food on irrigated land, but will also grow food for other parts of the country less advantageously circumstanced in this respect; and thus each district will grow chiefly food, cotton, or other articles for which their climate and soil are best adapted, according to what they can sell with most profit, and without reference to what can be consumed on the spot. It is self-evident, that if a revenue be received in bullion, and a part of it is constantly being sent away while the district produces none, the people must have the means of sending something it does produce, to bring back the balance of the bullion; but what can this have to do with the question, whether the inhabitants shall grow food on irrigated or on dry land? or how can it help to keep up the supply of bullion, to have the people growing their food with a greater expenditure of labour, rather than with less? On the contrary, the growth of food on irrigated land does directly facilitate the recovery of the exported bullion, because less time and labour being employed in growing food for consumption on the spot, the people have more time to spare for the growth or manufacture of articles to be sold to those who have superfluous bullion, and can also afford to sell at a lower price.

There are, moreover, two plain and visible refutations of all that has been said and written against the extension of irrigation in the Madras Presidency :—

1st. That the only district that has invariably prospered and increased in wealth and revenue (Tanjore) is the only one that has been anything like fully irrigated.

2nd. That there is at this time a dreadful scarcity of food extending almost throughout the Presidency, which would not have been the case, to the smallest extent, if the country had been properly irrigated.

There is little doubt that in this one year (in spite of high prices) there will be lost in Revenue and property a sum sufficient to have secured the country for ever from serious deficiency of food, if expended on works of irrigation; or sufficient to have supplied the country with a magnificent system of cheap communications. It is estimated that in one district alone there will be a loss of *Revenue* of seven lacks (£70,000), implying a loss of *property* of at least twenty lacks (£200,000); and yet, when it is proposed to spend two or three lacks a year (£20,000 or £30,000) in such a district on Public Works, the proposition is considered utterly visionary on account of expense. In fact, the loss of 100 lacks

(one million sterling) to the Government and people, in Revenue and property, has hitherto been considered of far less moment, than the direct outlay by Government, of five lacks (£50,000).

In reference to the importance of this subject, as measured by the amount of Revenue dependent upon the present irrigated lands, I must first remark, that there is no means of correctly ascertaining that amount, because the Revenue actually received (of which alone we have returns) is, in consequence of the irrigation works being so much out of repair, very much less than would otherwise be derived from the land. The portion at present irrigated (about two and a quarter million acres) pays a Revenue of 130 lacks (£1,300,000) even with the present very defective means of irrigation; whilst the unirrigated land (eighty millions of acres cultivated and waste) pays in all only 230 lacks (£2,300,000); so that the irrigated land, though comprising only about one-fortieth of the whole area of the country, yet pays rather more than a third of the whole Land Revenue; and if the existing irrigation works were only put in proper repair, the irrigated land would undoubtedly yield an additional Revenue, equal probably to half that at present derived from unirrigated land.

How remarkable it is, then, that works, upon which so much of the Revenue and yet more of the welfare of the people depend, should have been thought so utterly unworthy of attention, that thirty years ago only four Officers (not one-fiftieth of the number really required for superintendence) were nominated to take charge both of these works and the communications of the country; and although the department has been constantly increasing since then, there are not even now one-fifth of the number of superintendents really required. It is evident indeed that there is still no right apprehension of the matter, from the fact, that though the increase of the Corps of Engineers has been urged by every body concerned for more than twenty years past, a Despatch has lately been received from the Court of Directors on the subject, speaking, it is true, of some future augmentation, but still avoiding the actual question of immediate increase to the establishment; and thus after all the agitation of this subject, we are only just where we were twenty years ago in this respect. We do not want Despatches saying that the Corps *shall be* augmented, these we have had I believe before; but what is really wanted, is either an actual and immediate increase by three Battalions at least, to be filled up as fast as Officers can be obtained, or some equally efficient provision for the supply of European Superintendents for Public Works. The question is not, "Has the increase of Engineers been talked of, written about, or promised?" India will never be a bit the better for this system; it has been tried for thirty years in this Presidency, and has totally failed. The question is, "Has the number actually been increased?" In this, as in many other cases, nothing can be more true than the saying, "Where there is a will there is a way."

There are now about thirty Military Engineers in this Presidency; and, besides the Railway Engineers, there are upwards of thirty Officers (not trained Engineers) employed on Public Works, but still not one-fourth of the number required to put the country in a decent state within a long series of years. Why not permanently withdraw some Officers from these regiments, for employment of this nature? There ought to be at least a million sterling spent annually on Public Works in this Presidency, and we should require about 300 Engineers, besides subordinate Europeans, properly to superintend such an outlay. Supposing that only one lack (£10,000) a year ought to have been allowed for Public Works in each district ever since we obtained possession of it, we are now at least half a million sterling in arrears for each district, or ten millions for the whole Presidency.

What we now have to do, is,—

1st. To *secure* an ample supply of food by means of thorough irrigation:

2nd. By the same means, to provide for that food being grown with a moderate expenditure of labour.

At present about three out of four of the population are employed in raising food, or are dying for want of it, according to whether the season is good or bad; but before we can do much to improve the state of the country, we must so arrange, that one out of four will be sufficient to provide food for the whole without danger of famine, excepting under such circumstances as cannot be foreseen. This must be the foundation of everything, because people must eat; *and so long as nearly the whole population are employed in providing food, there can be no room for any great improvement in the circumstances of the people.*

3rd. We have to provide, by communications, ports, &c., for the transport of things, which can be bought cheaper or sold dearer at a distance, than at hand.

In order to ensure a constant and abundant supply of food from irrigated land, for the population of the whole of India, we must have 200,000 millions of cubic yards of water stored up, for distribution as required over the land; for which purpose, a capital of about 100 millions sterling would be required. This, however, is only sufficient to ensure the necessary quantity of *food* for the present population; besides which, we must of course provide food to meet the wants of the rapidly increasing population, as well as water for the irrigation of sugar, indigo, and other kinds of produce, which would involve a further outlay of suppose fifty millions sterling. Further, we have to construct at least 100,000 miles of low speed communications, which, if costing on an average only Rs. 10,000 (£1,000) a mile, would amount to 100 millions sterling for the whole; and then there are the ports as yet untouched, so that in order to develop the resources of the country, we should have no difficulty in spending to advantage 300 millions sterling, even without reckoning a system of high speed railways, which we must add when

we have first provided for our *necessities*, by ensuring *cheap* food and *cheap* transit.

When speaking of the *whole food* of the country being grown by means of irrigation, we must not be understood to mean, that this food should consist entirely of rice; for irrigation may be used for all other kinds of grains as advantageously as for rice. It is worthy of remark, that though under the present system, in the Madras Presidency, many things besides rice are grown on land artificially irrigated by the people themselves, rice *only* is grown on lands irrigated by means of water supplied by Government; for this most remarkable reason, that no opening is given for the growth of other things, in consequence of the high tax on irrigated land. Whilst dry land is assessed at one rupee (2*s.*) per acre, *irrigated* land pays ten or twenty rupees (£1 to £2), so that the cultivator has no option but to grow the crop which will make the best use of the greatest quantity of water, and yield the greatest amount of produce on *a certain space*. The question with him therefore, is not, "How can a certain quantity of water" (for the provision of which Capital has been required) "be employed to the best advantage?" that is, whether by applying it in large quantities to a small extent of land as for rice, or in less quantities to a greater extent as for other articles of produce? He pays so much per *acre*, and not so much per cubic yard of water; so the great question with him is, of course, how to get the greatest quantity of produce out of a small extent of land. For all we know, the same quantity of water might be ten times as profitably employed on ten acres of indigo, cholum, or oil-seeds, &c., as on one acre of rice. This has been a very great mistake, and ought at once to be remedied. In most parts of the country there is plenty of land waiting to be cultivated, which Government can supply to the cultivator without outlay; but all the water Government has to dispose of, has cost money. The *water* therefore should be sold, and little more than a nominal rent charged on the land, which, indeed, when the water applied to it is paid for, might be entirely free; and the cultivators would then of course apply the water in the way most profitable to themselves, and consequently to the community. It is more than probable that this system would add a vast amount to the prosperity of the community, by turning to account a vast extent of land at present lying waste, and enabling the people to apply the water to any crop, and in any way they may find most profitable. Indigo, for instance, though requiring little water, is at present a very precarious crop, and might probably be made prodigiously more profitable, if the cultivator had in hand only a comparatively small supply of water to provide against an interval in the rains. Each acre would require for one good watering, say about 400 cubic yards, which would cost the Government only about three pice ($\frac{3}{8}$*d.*); and if charged at ten times that rate, it would still only cost the cultivator two and a half annas ($3\frac{3}{4}$*d.*) per acre, whilst it might make

the difference of securing a crop worth five or ten rupees (10*s*. or £1) which would otherwise be entirely lost, or might at least increase the value of a crop by two or three rupees (4*s*. or 6*s*.). A little experience of this kind would no doubt lead to much better arrangements about the distribution of water than we have at present; but at any rate, it is not to be imagined that we are to continue the *slovenly*, *wasteful* system hitherto pursued.

It must be borne in mind further, that the benefit of irrigation is not merely in moistening the spot of ground to which water is led; this is only a part of the subject, for water not only assists the growth of a plant as far as moisture is concerned, but further actually conveys to it a large portion of the nourishment it requires, even when the water flows off nearly clear from a tank in which it has deposited most of the matter brought down from the uplands in a state of suspension, and retains only what is chemically combined with it; and this is proved by the fact, that in general such irrigated lands are not manured. But in the case of land irrigated from river channels, the benefits derived are of course much greater; for as the water reaches it, without having been stationary at all, a large quantity of the richest manure is carried in a state of nearly mechanical mixture with the water, and deposited on the land, and the consequent saving of expense in cultivation is enormous. Lands in Tanjore have thus borne two white grain crops annually for centuries, without any other manure. Supposing that one million cubic yards of water per hour are distributed by means of the Godavery works, then, probably 1,000 tons of solid manure are every hour deposited on the land, without the cost of either carriage or of spreading, and we leave the farmer to calculate the value of this. Now the Godavery actually conveys to the sea about 150 million cubic yards of water per hour, in a high fresh, containing probably 150,000 tons of manure, and if we value it at only one-tenth of that of Guano, we find that manure to the value of £150,000 per hour, or three and a half million sterling per day, is constantly being carried into the sea. Land is even *made* by this process; that is, worthless land thus irrigated from rivers, is in a few years converted permanently into land of the highest fertility.

Again, every square mile of irrigation is a benefit to the whole neighbourhood, both by moderating the temperature and causing dew, and thus also every mile of canal, independent of the irrigation from it, and the transit by it, is a public benefit as contributing to the means of supplying water and forage for cattle. In most parts of India, during the dry season the cattle have to go several miles for water, and this at the time too, when they can scarcely find anything in the shape of herbage to eat.

I may here also speak of the use of water in cotton cultivation. Colonel Grant, Major Lawford and others have testified to the excellent effect of irrigation upon this crop, and there can of course be no question

but that the cotton is constantly comparatively deficient in produce, for want of water at some period of its growth. I have shown that the cost of fully supplying the Godavery Delta with water, providing for one or even two crops of rice and reserving a considerable quantity of water for the rest of the year, will be annually only about three annas ($4\frac{1}{2}d.$) per acre, supplying about 8,000 cubic yards. One watering of an acre, when the land is very dry, may be taken to require 250 cubic yards (two inches depth of water), so that to provide one watering for a crop of cotton would cost about one-thirtieth part of ($4\frac{1}{2}d.$) somewhere about $\frac{1}{7}d.$; and if this increased the crop to the extent of one-tenth, making an addition of suppose 10 lbs. of cotton (worth on the spot 1*s.* 3*d.*), then the benefit derived would be worth one hundred and fifteen times the cost of the water. I need not here go into further detail about this; but if the papers of the American Cotton planters employed in India be examined, it will be seen how strongly they insist upon the deterioration in the quality of cotton, as well as deficiency in quantity, caused by drought.

Navigation.

We may next estimate the value of water for navigation. There are three ways in which water may be so used :—

1st. In keeping the rivers navigable;

2nd. In supplying canals which are kept on a dead level, so that the only consumption of water is in evaporation and lockage;

3rd. For flowing canals.

As the use of water for the artificial supply of rivers for navigation is not in practice in England or America, and has never (so far as I know) been even suggested in Engineering works in those countries, until of late by Mr. Ellet, in his admirable papers on the navigation of the Mississipi, it will be necessary to go as fully into it here, as our present data will allow. I should mention, that I remember many years ago hearing, that in Russia some rivers are made navigable upon this principle, though only in an imperfect manner. Water stored in lakes or reservoirs is discharged at certain fixed intervals into the streams, so as to give a flush for a few days, which is taken advantage of by the boats which have previously been collecting in the line of navigation; and this is precisely the plan I would propose, excepting that the supply should be made constant. That this plan should never have been adopted in England is perhaps owing partly to the considerable fall per mile which the rivers there generally have, and also to the value of land and consequent expense of reservoirs; but is more probably owing to the idea never having occurred to Engineers there. Mr. Ellet seems to have been the first to suggest the plan in America, and whether it has yet been acted upon I do not know; but his report is one of the ablest papers ever written by an Engineer, and will one day assuredly be duly appreciated. In a lake country, like Wales and others, there are peculiar facilities for such an undertaking; because, by closing the

mouths of the lakes, large bodies of water may be retained at a comparatively small cost; and in this way, it was suggested by an Indian Engineer some years ago, to improve the Severn navigation. In Van Dieman's Land the experiment was tried many years ago by placing a slight dam at the mouth of one of the innumerable lakes there, so as to secure, during the summer, a better supply of water for the mills situated on the river that flows from the lake. A very complete work of this sort was also executed in that island (at the suggestion of an Indian Engineer) at the head of another river; a large lagoon, situated high up in the hills, being dammed up by a high and strong earthen bund, furnished with a sluice, so as to form a tank, and secure a very considerable body of water. In that part of the island the fall of rain is extraordinarily small, and the river issuing from this lagoon was always dry for five months in the year, and sometimes had scarcely any water in it, even in the winter; but since the year 1839, (when the bund was built), till it was last heard of, in 1848, the river had never been without a large stream in it, and in one year, when there was an almost total failure of rain, the supply of water from the tank was sufficient to keep up the stream through a whole winter and following summer, with scarcely any other accession of water.

This mode of improving the navigation of Indian rivers has been singularly lost sight of; and what makes it still more remarkable, is, that the abstraction of water from navigated rivers for purposes of irrigation, to the endangering of the navigation, has, to a certain extent, roused attention to the subject; so much so, that a few years ago an experiment was made in the Jumna, to try what effect the abstraction of the water had upon that river. By merely closing the canals that lead from it, for four days in the dry season, the water in the river was raised one and a quarter feet, and would probably have risen more had the canals been kept closed for a longer time; since it appears from the diagrams, given in the report published, that the river continued to rise up to the last moment before it began to fall again, in consequence of the canals being re-opened. Had the canals been kept closed sufficiently long, the river would have remained stationary for a time when at its highest. The quantity turned into it was about half a million cubic yards per hour, showing that twelve millions of cubic yards a day, or 360 millions a month, would, in the low state of the river, have afforded an additional depth of one and a quarter feet; and supposing the river to have had two feet depth in its previous state, this additional depth would make the difference between a stream scarcely navigable, and one quite available even for steamers. This is a highly important experiment, as giving the positive effect of a known quantity of water in an ordinary Indian river of a certain size; but it is unfortunate that no observations were made as to the effect of this addition in the Ganges below the confluence of the Jumna. No doubt, however, the effect would not have

been less than three-quarter of a foot on the depth of the main river; for although the lower Ganges is much wider, its fall per mile is less than that of the Jumna. The report of this experiment is published in the papers of the Agra Presidency; but one reason probably, why even this did not awaken attention to this most important subject, is, that public attention in England has of late years been wholly absorbed by railroads as means of communication, and the impression upon people's minds generally, and even upon those of many Engineers, has been that we have done for ever with internal water communication, and that railroads have entirely taken their place. This idea is, however, entirely without foundation, for railroads probably never can supply the place of water communication, because, as far as yet appears, the cost of working them will far exceed that of navigable rivers or canals. Railways cannot contend with canals in cheapness, even where they have the immense advantage over them of steam-power; and steam-canals, such as are now in use in Canada and the United States, are worked so cheaply as to leave scarcely any possibility of railroads ever competing with them in this respect, which is the main point as regards the great mass of traffic everywhere.

It is from a misapprehension on this point, I conclude, that even when the subject was so nearly brought forward, in consequence of the canals in the North-West being led off from navigated rivers, it still escaped thorough investigation, although a few minutes' calculation would have shown that the subject was well worthy of the closest scrutiny. The Ganges is the grand artery of Bengal and the North-West Provinces, and upon cheap transit by means of it hangs the whole present state of things there. Not a tenth part of the goods carried down it could bear the cost of 500 miles of land carriage, nor even the doubling of the present cost four pice ($\frac{1}{2}d.$) per ton per mile; so that without this cheap line, *the trade of Calcutta and the Revenue of Bengal and the North-West would fall to a small fraction of what they now are.*

We will now proceed to form an estimate of the value of water for the navigation of rivers, from such data as we have, beginning with the Jumna, as we have already an approach to an experiment, in the effect of a certain quantity of water on it. It is stated in the railway pamphlets, that the traffic above Allahabad is one million tons a year, and if we take this as equally divided between the Jumna and the Ganges, or 500,000 tons to each, and reckon the present cost of transit, at four pice ($\frac{1}{2}d.$) per ton per mile, and the mean distance of transit, at 300 miles, it will be found, that a sum of thirty lacks (£300,000) is annually paid for transit on the Jumna. But additional water thrown into the Jumna also raises the Ganges, and the cost of traffic on that river below the confluence (calculating about 2,000,000 tons for 550 miles at four pice ($\frac{1}{2}d.$) per ton per mile) amounts to about 230 lacks ($2\frac{1}{4}$ million sterling). If this traffic were equally distributed over the whole 1,200 miles of navigation from

Delhi to Calcutta, it would give one and a quarter million of tons, carried the whole distance at a cost of Rs. 18,000 (£1,800) per mile; and if we suppose half of this to be carried during the six driest months, when the river is injuriously low, we have 600,000 tons, carried the whole distance, at a rate of Rs. 12,500 (£1,250) per mile; or, on the whole length of navigation, a total of one and a half million sterling, affected by the state of the river. Any increase or diminution of depth, which affected the cost of transit to the extent of one pie ($\frac{1}{8}d.$) per ton per mile, (one-fourth of the present rate), would therefore increase or diminish the sum expended on transit, to the extent of nearly £400,000, or forty lacks a year. So important is this magnificent line of navigation; but this difference of rate of transit would in reality produce a much greater effect than shown by this sum of money, in so far as it would materially increase or diminish the amount of traffic. Many kinds of goods, which would be worth moving if carried at four pice ($\frac{1}{2}d.$) per ton, or twenty rupees (£2) for the whole average distance of 950 miles, would not bear a charge of five pice ($\frac{5}{8}d.$) a mile, or twenty-five rupees (£2 10*s.*) for the whole distance; and, on the other hand, many things that are not worth a transit cost of twenty rupees (£2) a ton, would afford a merchant an ample profit, if carried at fifteen rupees (£1 10*s.*). So immense is the effect of the cost of transit indeed, that a difference of one rupee (2*s.*) a ton, on a distance of 1,000 miles, would often be sufficient to turn the scale, and render an article saleable at a distant market, or otherwise.

The question then remains, What increase of depth of water is sufficient to effect a diminution of one-fourth, or one pie ($\frac{1}{8}d.$) per ton, in the present cost of transit? Supposing the Jumna to be, on the average of the six dry months, two and a half feet deep at the shallows, and that the above quantity of water (twelve millions of cubic yards a day, or 360 millions a month,) raised the river one foot on an average of the same time, (thus providing a depth of three and a half feet), this may fairly be supposed to allow of the boats carrying double what they would, when drawing only two and a half feet; and a double load on the same boat would of course nearly, if not quite, halve the cost per ton of working it, for, besides the additional load, there would be the advantage of much less delay and risk from running aground. In the Ganges, the difference of depth would be less, perhaps on an average about half a foot; but we shall be within the mark, if we calculate that this addition of water would reduce the cost of transit by one-fourth, making a difference of one pie ($\frac{1}{8}d.$) per ton per mile, and producing a total saving of forty lacks (£400,000) a year, besides all the profit in the new traffic created by the reduction of rates. The quantity of water required (as above) to produce this effect, is twelve millions of cubic yards per day for 180 days, or, in all, 2,160 millions of cubic yards; and this divided between forty lacks (£400,000) gives 540 cubic

yards per rupee (2*s.*). But this is certainly a very low estimate; and, in the case of the Ganges and its feeders, we may therefore confidently reckon water worth one rupee (2*s.*) per 500 cubic yards.

Let us now take another river. The Godavery is at present not navigated at all by boats, owing mainly to the uncontrolled powers of the petty Zemindars on its banks throughout the Hyderabad country, who assume the right of demanding dues on every thing that passes,* and the vexations thus endured by the owners of timber and bamboos rafted down the river, are quite enough to prevent any traffic by boats. It has, however, at a previous period been navigated for six months in the year, *viz.*, from the middle of June to December; and probably during this time there is never less than three feet at the shallows, as far as Wooni on the Wurdah, 400 miles from the sea. In December there is an average flow of about 600,000 cubic yards per hour, and when the river is at the lowest, about 100,000. To keep up a depth of three feet throughout the dry season, would probably require an average addition of 400,000 cubic yards per hour; or, for the six months, 1,800 millions. Our data at present are far from sufficient to enable us to calculate with certainty, but we shall probably be quite safe in allowing that 3,000 millions would give at least 700,000 cubic yards per hour throughout the year.

The traffic from the upper part of the basin of the Godavery towards Bombay and the Ganges, appears, from the statements given by the Railway Engineers, to be at least 100,000 tons a year, of goods merely seeking the cheapest access to a port, and which would consequently be all carried by the Godavery, if the navigation were open. In such a case as this, however, it is evident, that the present amount of traffic cannot in the remotest degree indicate the amount of traffic there would be by the river, if easily navigated. At present, goods are either carried from the upper part of the Godavery basin to Bombay, over 300 miles of land, at three annas (4½*d.*) per ton per mile, equal to fifty-six rupees (£5 12*s.*) per ton for the whole distance, or else conveyed 400 miles by land to the Ganges, at about seventy rupees (£7) per ton *for the whole distance*, and thence by the latter river 600 miles to Calcutta at four pice (½*d.*) per ton per mile, or twelve rupees (£1 4*s.*) per ton for the voyage, making a total from Berar to Calcutta of about eighty rupees (£8) a ton. On the Godavery, if that navigation were put in order, the cost would be only about two pice (¼*d.*) per ton per mile, or a total charge of nearly five rupees (10*s.*) per ton, for carriage from Berar to the Port of Coringa. And if to this we add an average of thirty miles of land carriage, (which would take in a great range of coun-

* In the late voyage of a Cargo Boat, eight or ten of these Zemindars demanded tolls, one of them to the amount of 30 per cent. on the value of the cargo, and this is not at all the limit; they take upon themselves the authority to demand as much more as they please.

try), it would add only five and a quarter rupees (10*s.* 6*d.*) per ton, so that the total charge would be not more than ten and a quarter rupees (£1 0*s.* 6*d.*) per ton, about *one-seventh* of the present average cost of carriage to Bombay or Calcutta. If the river were opened, no doubt the land communications leading to it would soon be improved, and the total cost reduced much below this; but I take the cost by land as at present. Now, if instead of a traffic of 100,000 tons, we suppose 500,000 tons to be conveyed at this reduced rate of one-seventh of the present cost of transit, then, calculating the saving at only fifty rupees (£5) a ton, there would be a total saving of 250 lacks (two and a half millions sterling) a year; which, divided by 450 miles of navigation, would be Rs. 55,000 (£5,500) per mile; and, supposing that half of this traffic were carried during the six months of the year, when the river is now navigable, it would still leave half that sum, or Rs. 27,500 (£2,750) a mile per annum, as the direct saving effected by throwing water into the river. Besides this, a great portion of the other half also should be credited to the improvement, because the keeping the river navigable throughout the year would be the principal thing to lead to its navigation generally; and we may therefore safely allow Rs. 35,000 (£3,500) per mile as the value of the water, or 140 lacks (nearly one and a half million sterling) a year, for the whole distance of 400 miles.

If we require (as above calculated) 3,000 millions of cubic yards of water thus to improve the navigation of the Godavery, this, divided among the 140 lacks (one and a half million sterling) saved, gives 200 cubic yards per rupee (2*s.*) against 500 cubic yards per rupee (2*s.*) calculated as the value of additional water in the Ganges, which is not out of proportion, because the whole traffic of the Godavery basin being at present carried by land, the saving by water carriage is of course much greater, even on a smaller amount of traffic.

We may next try to calculate the value of water used for navigation in an ordinary canal. We have some data for the cost of a canal, in the case of the Ganges project, where 850 miles of canal, varying from sixty to ten yards wide, and from ten to six feet deep, is expected to cost 160 lacks (£1,600,000), or about Rs. 20,000 (£2,000) a mile. This canal has very few locks, but it has some very heavy works near its head. From this, as well as from general experience in Hydraulic works, I think we may safely allow, that a vast extent of complete steam-canals, twenty-five yards broad and three deep, with locks, to admit screw steamers of 300 tons, might be executed in India at Rs. 15,000 (£1,500) a mile. There are of course tracts of country where they would cost much more than this; but we need only at present occupy ourselves with those where such works could be executed, without excessive expense. We may take for example the line connecting the two Coasts of the Peninsula, from Negapatam in Tanjore, to Ponany on the West Coast, a distance of 350 miles, one of the most important lines that could be found.

1st. As passing through a vast population, having near its line towns of 20,000, 30,000, 60,000, 100,000 (Trichinopoly), and perhaps 40,000 (Coimbatore) inhabitants; so that within fifty miles on either side, there are probably four millions of inhabitants.

2nd. As connecting two Coasts, each of which are closed to trade for about three months of the year, but at different seasons, so that by means of very cheap water transit between the two, the produce of one Coast could be shipped at the opposite Coast, at that season when the one is open to trade and the other closed. On this line there is not a single serious Engineering obstacle; there is an ascent of about 900 feet to the water shed, which would require on each side about ninety locks, or nearly one in two miles; but near the water shed they might be placed by two or three together. They would cost about Rs. 10,000 (£1,000) for every ten feet of lift, or about Rs. 5,000 (£500) a mile. The excavation, &c., on this easy line, could be done at a cost of Rs. 10,000 (£1,000) a mile, making in all Rs. 15,000 (£1,500) a mile for the whole length of canal. If the locks were 150 feet long by fifteen broad, the water consumed by them, allowing a traffic of 300,000 tons (1,500 boats of 200 tons each) at 1,000 cubic yards per lock-full, would be one and a half million cubic yards, or 4,000 cubic yards per mile of canal. And the consumption of water by evaporation, allowing a breadth of twenty-five yards, at two yards per annum, or an average of one-fifth of an inch a day throughout the year, would be $25 \times 1,800 \times 2 = 90,000$ cubic yards per mile, or, including leakage, say 100,000 cubic yards per mile. The loss by leakage would, however, be very small; for in the Peninsula, if good slopes are allowed, tanks and channels become soon puddled by the sediment from the water. If the traffic were 300,000 tons a year, (which it would certainly be on this line, including the immense passenger traffic there would be), then, taking the present cost of carriage at two and a half annas ($3\frac{3}{4}d.$) per ton per mile, and the charge on the canal at one pie ($\frac{1}{8}d.$), the saving in transit by the canal would be Rs. 46,000 (£4,600) a year, for a consumption of 100,000 cubic yards of water, or two cubic yards per rupee (2*s.*). But in this case there would be required for the canal, a Capital of one rupee (2*s.*) for every five cubic yards of water, in addition to the cost of storing it.

Though these calculations are far from showing accurately the value of water for different purposes, yet they undoubtedly give it sufficiently near for our present purpose, *viz.*, to show that its *value* is extraordinarily high as compared with its *cost*, which last we now proceed to estimate.

There are two methods of obtaining a command of water for irrigation, &c.: 1st, by diverting it from rivers, by means of weirs and channels; 2nd, by damming up small streams with earthen bunds, and thus forming tanks, in which it is stored up during the local rains.

Godavery Irrigation.

We have a good instance of the first mode, in the Godavery works. Up to the present time about eighteen lacks (£180,000) have been spent on these works, (besides annual repairs), and probably seven lacks (£70,000) more, in all twenty-five lacks (£250,000) will complete the whole undertaking, including the making all but the very small channels navigable, so that there will be about 1,200,000 acres irrigated and drained, and almost 1,000 miles of good navigation. The total cost of the water so distributed may be thus estimated:—

4 per cent. on twenty-five lacks (£250,000).	Rs.	1,00,000	(£10,000)
Repairs and management.	„	1,20,000	(£12,000)
Total annual expense . . .	Rs.	2,20,000	(£22,000)

The total quantity of water distributed for this sum will be as below:—

1,200,000 cubic yards per hour for five months.	4,300	millions of cubic yards.
400,000 cubic yards per hour for seven months. . . . . =	2,100	„ „ „
Total per annum...	6,400	millions of cubic yards.

This divided between the above Rs. 2,20,000 (£22,000) gives 30,000 cubic yards per rupee (2*s*.). But this includes the cost of both irrigation and navigation; and if the benefit of the latter be only one-fourth of that of the former, it will leave the *cost* of the water for irrigation at about one rupee (2*s*.) per 40,000 cubic yards against from 300 to 1,000 cubic yards per rupee (2*s*.) for its *value*.

We may observe that there cannot be much room for error in this calculation, because the works are now so far advanced as to enable us to form a very fair judgment of their total cost.

Who can be surprised at Hydraulic works being profitable both to Government and the people, when we find that the *cost* of the water is only one-fiftieth part of its *value!* It must be remembered that this water is applied to the richest alluvial land, and that in the freshes it comes down loaded with such a rich sediment, as perfectly to renovate the land annually. In Tanjore the land has borne either one or two crops of rice annually, for centuries, without any manure, although a great part of the soil is of very inferior quality.

The Godavery is, it must be allowed, a case of river irrigation on a very large scale, and gives perhaps the lowest rate at which water could be obtained for irrigation in this way. The works are, however, heavy; the weir having a clear water-way over it of two and a quarter miles broad, besides six large sets of sluices, three locks, wing-walls, &c., in a river

with a bed of loose sand, and twenty-nine feet deep in the freshes. The three main channels will together have a breadth of about 130 yards at their heads, and there will probably be 1,500 miles of channel, 5,000 irrigating sluices, and fifty locks, besides small weirs, aqueducts, tunnels, bridges, groynes, &c., to restrain the river.

Tanks.

The cost of obtaining water by the second means, *viz.*, by constructing tanks to collect it during the local rains, may be shown thus:

It is evident, that if the fall of the country be only eight feet a mile, which is much above the average fall in India, a bund, ten yards high, would retain water of a breadth at the surface of nearly four miles, or 7,000 yards; and as its mean depth would be half of that at the bund, the quantity of water stored per running yard of bund, would be $\frac{7{,}000 \times 10}{2} = 35{,}000$ cubic yards. This is the simplest form of the question. In practice, sites for tanks would always be chosen where the form of the ground assisted the operation, that is, where a natural rise or a hill would form part of the bund; and allowing, that with such assistance, the capacity of the tank, in comparison of the length of the bund, would be doubled, (which is probable), this would give 70,000 cubic yards for every lineal yard of bund. To retain water ten yards deep, would require a bund about thirteen yards high, five yards broad at the top, and sixty at bottom, containing about 400 cubic yards of earth for every running yard, which, in the Peninsula, would cost about one anna ($1\frac{1}{2}d.$) per cubic yard, or twenty-five rupees (£2 10*s.*) per lineal yard of bund. This must be lined with loose stone at a cost of about five rupees (10*s.*) for ten cubic yards (at eight annas (1*s.*) per cubic yard) which, added to the above twenty-five rupees, makes up thirty rupees (£3) per lineal yard of bund. To this must be added something for a waste weir and sluices; suppose ten rupees (£1) makes a total of forty rupees, the annual cost would then be as below:—

	Rs.	A.	£ *s.* *d.*
4 per cent. on forty rupees (£4)......	1	10	(0 3 3)
Repairs, &c., at 2 per cent..........	0	13	(0 1 $7\frac{1}{2}$)
Annual cost per yard of bund . . . Rs...	2	7	(£0 4 $10\frac{1}{2}$)

or about two and a half rupees for 70,000 cubic yards of water, equivalent to 28,000 cubic yards per rupee (2*s.*).

If the whole of the water is to be used for one crop of rice, or in a time little longer than the rains last, we may safely add to its contents fifty per cent. for the water that will be added after it is first filled, to replace the water drawn from it for irrigation. This will therefore make the cost one rupee (2*s.*) for 42,000 cubic yards.

But if, as in the case of large tanks from which irrigation is carried on all the year, an allowance is to be made for evaporation, we may

reckon that the gain by refilling during the monsoon about balances the quantity withdrawn.

Every square mile of country gives, as above shown, two millions of cubic yards of water; and consequently for a tank containing 100 millions, (the capacity of the Veranum tank in South Arcot), the drainage of fifty square miles, or an area of seven square miles would be required.

Ganges Irrigation.

Let us next see what the cost of water is in the North-West Provinces. According to Captain Baird Smith's estimate, the cost of water for irrigation there is as follows:—

The Ganges canal is estimated to cost 160 lacks (£1,600,000) and to supply 900,000 cubic yards of water an hour, or 8,000 millions per annum, which would show an expenditure of Capital of one rupee (2*s.*) for 500 cubic yards per acre; and if we allow four and a half lacks (£45,000) a year for current expenses (7*d.* per acre), the actual cost of water at the present rate of interest will be as follows:—

4 per cent. on 160 lacks (£1,600,000) ..	Rs.	6,40,000	(£ 64,000)
Annual expenses	„	4,50,000	(£ 45,000)
	Total Rs.	10,90,000	(£109,000)

which, divided among 8,000 million cubic yards, gives 7,300 cubic yards for each rupee (2*s.*).

The cost of the Western Jumna canals has been (as appears from the same authority) twelve lacks (£120,000) for a supply of 300,000 cubic yards per hour, and the current expenses are Rs. 90,000 (£9,000) per annum, showing the cost of water to be as below:—

4 per cent. on twelve lacks (£120,000)....	Rs.	48,000	(£ 4,800)
Annual expenses	„	90,000	(£ 9,000)
	Total Rs.	1,38,000	(£13,800)

which, divided between 2,500 million cubic yards, gives 18,000 cubic yards per rupee (2*s.*).

The cost in the North-West is therefore from 7,300 to 18,000 cubic yards per rupee (2*s.*) against about 27,000 cubic yards per rupee in Rajahmundry. The cause of this excess of cost in the North-West is partly from the difference in the nature of the works necessary there to lead the water to the surface of the land, and partly from the works being executed upon a more expensive plan.

Of the cost of water in the North-West, if obtained by means of large tanks, we have no account, as such works have not yet been executed by our Government; and I have no calculation of the cost and capacity of the small tanks constructed in that part of the country in former years. I think, however, that in a country with so moderate a fall as that part has,

water could be stored in tanks much more cheaply than it could be drawn from the river; but this would involve the great disadvantage, that the tanks would not suffice to prevent a famine, unless a supply was always left in them sufficient for the second year, in case of a failure of the local rains; and for this purpose it would be necessary to make them of a capacity to contain about three times the quantity required to irrigate the lands dependent on them for one year, so as to provide for two years' consumption, as well as for the great evaporation there would be in a year of drought. If, however, these tanks could be made to retain water, at a cost of 22,000 cubic yards per rupee (2*s.*), they would still be as cheap as the Ganges canal irrigation works, and would have the immense advantage over the latter, of leaving the river navigation entirely uninjured (except in the case of a drought), which is the most important part of the whole question.

Ganges Navigation.

When we take into consideration the river navigation in calculating the cost of water in the North-West, it entirely alters the case. In the above calculation of 7,300 cubic yards per rupee (2*s.*), we suppose that the water while in the river is of no value; but in estimating the value of water for navigation in the Ganges, we find, as above shown, that it is probably worth not less than one rupee (2*s.*) per 500 cubic yards. But, indeed, the real value of the water for this purpose cannot be correctly calculated. It is not merely that the diminution of water in the river would add a million sterling to the cost of transit of the present traffic, but that such an increase of cost would destroy a very large proportion of the trade. If the present traffic is on an average one and a half million of tons, and the average value of the goods is Rs. 100 (£10) a ton, the total value is fifteen millions sterling. An increase of one-fourth in the cost of transit, say from twenty to twenty-five rupees (from £2 to £2 10*s.*) might very possibly take off the profit of one-half the goods, or reduce the traffic by one-half, say to the amount of seven and a half millions sterling. It seems highly probable that the profit on one-half of the goods does not exceed five rupees (10*s.*) a ton.

When therefore we add to the cost of leading the water from the river, its value for navigation, it seems almost certain, that its abstraction from the river, is, excepting in case of famine, the gain of a loss unless the canal were continued to Calcutta; but this point must be further considered hereafter.

Captain Smith further supplies the following data for estimating the *value* of the water in the North-West:—

He reckons the increase of produce due to irrigation at 640 lbs., or ten and a half bushels per acre for one crop, making, at the rate of three quarters of a rupee (1*s.* 6*d.*) per bushel, eight rupees (16*s.*) in all; and allowing a similar increase for the other crop, we have a total of

sixteen rupees (£1 12*s.*) per acre per annum; and as the consumption of water is two-third cubic yards per hour, or 6,000 cubic yards per annum, the value of water would be one rupee (2*s.*) for 400 cubic yards, supposing that the irrigated cultivation entails no more expense than that of land not irrigated. No data are supplied on this point; but even if we allow for the expenses of cultivation so large an addition as six rupees (12*s.*) per acre, it would still give the value of water at 600 cubic yards per rupee (2*s.*). There is, however, a difficulty here, for the Government water rent is only one rupee (2*s.*) per acre, and if we reckon that there is a clear annual profit to the cultivator of ten rupees (£1) per acre, the Government charge seems to be disproportionately small; and irrigated land having so great an advantage over unirrigated land, it would appear as if there could be no competition between the two.

Upon these data, however, we have 600 cubic yards per rupee (2*s.*) as the value of water for irrigation in the North-West Provinces against 500 cubic yards per rupee (2*s.*) in Madras.

Ganges Canal Navigation.

We have now to reckon the additional value given to the same water, by its being used for navigation in the canal. If, as originally planned, the canal be continued to Allahabad, there will be 450 miles of navigation in one line. The present traffic by the river is estimated at one million tons, and the cost is about four pice ($\frac{1}{2}d.$) per ton per mile, which makes the total expenditure in transit on this line amount to ninety lacks (£900,000). I have no doubt that in the canal, with towing paths and a current in the direction of the main trade, and an ample depth of water, so that large vessels could be used, the cost of transit would not be more than half a pie ($\frac{1}{16}d.$) per ton per mile. On the Mississipi, where money is only one-tenth of the value it is in the North-West, the charge is sometimes one pie ($\frac{1}{8}d.$) a ton. The cost on the Rajahmundry canals is one pie or one and a quarter pie ($\frac{1}{8}d.$ or $\frac{1}{6}d.$), though they are far from being in complete order; and this is for very short trips, so that for trips of 200 or 300 miles, the cost would probably not exceed half a pie ($\frac{1}{16}d.$) per ton. The saving therefore by using the canal instead of the river, would probably be three and a half pice ($\frac{1}{2}d.$) nearly per ton per mile, or nearly eighty lacks (£800,000) a year on the whole present traffic; and this, divided among 8,000 million cubic yards, gives 1,000 cubic yards per rupee (2*s.*) for the value of water for navigation, in addition to that for irrigation.

But even this does not give its full value, for if the cost of transit were reduced to one-eighth of what it is at present, a very large increase would take place in the traffic. If the canal were continued to Calcutta, the increase would be immense; but even if only to Allahabad, the augmentation will still be very great, and we may safely allow, as profit on this new traffic, about half the sum saved in transit on the old traffic, or forty lacks (£400,000), which, with the above saving of eighty

lacks in transit, would make a total saving of 120 lacks (one and one-fifth million sterling) as the return for 5,000 million cubic yards of water, giving 660 cubic yards per rupee (2*s.*).

It must be observed, however, that this calculation supposes no increase of cost of transit to take place in the lower Ganges, from the abstraction of water; or, that some means are found to compensate for it, for it is evident, that as so large a portion of the upper Ganges traffic either goes to or comes from Calcutta, whatever increases the cost of transit in the lower Ganges will check the traffic in the canal above Allahabad.

There can be no question but that if the canal were continued to Calcutta, making the average cost of transit for 1,000 miles half a pie ($\frac{1}{16}d.$) per ton per mile, or two and a half rupees (5*s.*) per ton for the whole distance, several millions of tons a year would be added to the traffic, and the trade of the Port of Calcutta would be increased manifold. No system of railroads could possibly produce such effects, because they could probably never be worked at less than four times the cost of a canal.

If we now add together the value of water in the Ganges canal for irrigation, *viz.*, one rupee (2*s.*) per 600 cubic yards, and the value of the same for navigation, *viz.*, one rupee (2*s.*) per 660 cubic yards, we find the total value to be one rupee (2*s.*) for 315 cubic yards. And this shows the great economy of making irrigating canals navigable in this country; in this case it just doubles the profit upon the expenditure.

Perhaps, wherever a fresh water canal is made for navigation, it would be advisable to use it for irrigation also; and in the same way there can be no question but that where a canal is made for irrigation primarily, it should further be made navigable.

Rajahmundry Navigation.

If we add to the value of water for irrigation in Rajahmundry (as calculated above) its value for navigation (in the same manner as I have estimated it for the Ganges canal), the calculated results of that undertaking will be greatly increased. First, there will be at least 1,000 miles of navigation connected with the anicut. We have no sure grounds for estimating the traffic at present over the whole; but on some of the principal channels it is about 4,000 tons a month, or 50,000 tons a year.* As yet, however, no part of the district has been put fully in order, and not half of it has received water; so that the traffic is a mere trifle of what it will be, if the Delta continues to prosper. Probably the main channels will, before long, have a traffic of 500 tons a day, or 150,000 tons a year, and the average traffic of the whole may be half that quantity, that is, 75,000 tons a year, making a total of seventy-five million tons conveyed one mile, which, if carried by land at two annas (3*d.*) per ton, would cost about ninety-four lacks (£940,000) a mile, but when carried by the channels will not cost, at the utmost,

* On one channel the last monthly return shows 1,100 boats, properly 10,000 tons, or at the rate of 120,000 tons a year; perhaps already ten times what the traffic was three or four years ago.

more than one pie ($\frac{1}{8}d.$) per ton, or in all four lacks (£40,000) a mile, thus producing an annual saving of ninety lacks (£900,000) per mile on the whole traffic; which, divided between 6,000 million cubic yards, gives 700 cubic yards per rupee (2*s.*). It is evident that this way of calculating the gain by navigation must give it far too low; but it is in fact impossible to calculate the real extent of the advantage obtained, by enabling the people to grow and sell things, which, but for cheap transit, would be unprofitable. Taking the mean distance from the point of production in the Delta, to the Port or place of consumption within the district, or to the boundary, if exported by land, at fifty miles, the saving by water transit would be about six rupees (12*s.*) per ton. So that by means of canals, a vast trade might be carried on in articles which, for want of means of cheap transport, would be quite valueless unless consumed on the spot. We shall therefore be far within the mark in allowing an additional value of one rupee (2*s.*) per 700 cubic yards, as given to the water by the use of it for navigation, making its total value about one rupee (2*s.*) per 300 cubic yards. I have here supposed that the traffic on the channels increases from 150 tons a day (its present average) to 500 tons, which is surely not too much, if we take the following circumstances into consideration :—

1st. That the supply of boats is at present so totally inadequate that the charge for freight is about five pice ($\frac{5}{8}d.$), while the cost of working them is only about one and a quarter pice ($\frac{1}{6}d.$):

2nd. That not a fourth part of the land is yet watered :

3rd. That most of the channels in use have only been opened a few months :

4th. That only very little European Capital and influence have yet been brought to bear on the province :

5th. That the Delta is not yet one-third filled with population.

A curious confirmation of the above estimated value of water for irrigation is found in the case of a poor man who had a small garden, which he cultivated and watered himself. His time was equally divided between the two, and he earned two annas (3*d.*) a day by the produce. He raised the water sixteen feet, and used seventy cubic yards in two days; and his gain being two annas (3*d.*) a day, this makes the value of the water to him, 560 cubic yards per rupee (2*s.*). Now, if instead of raising this water himself at the cost of a day's labour, he had obtained it from the Government, who, by providing it on a large scale, could sell it at 30,000 cubic yards per rupee (2*s.*), he might have had the seventy cubic yards for $\frac{1}{400}$th of a rupee or half a pie ($\frac{1}{16}d.$) ; that is, for one-fiftieth part of the sum he received from it as profit.

Cost and Value of Water.

We thus find, that when provided on a large scale, water can be obtained in India for one-fiftieth part of what it is worth ; that Govern-

ment do actually obtain it at about 30,000 cubic yards per rupee (2*s.*); and that when applied to the land and to navigation, it is worth at least one rupee (2*s.*) per 500 cubic yards.

Is it then surprising, that the new works of irrigation executed in Madras within the last thirteen years, should yield on an average 70 per cent. to Government in direct Revenue, besides the amount of indirect Revenue, arising from the increase of duties on articles which the improved condition of the people enables them to consume? Or is it surprising that in Tanjore one and a half million sterling have been added to the saleable value of the land, since the construction of the Colleroon weirs? Those works were executed in 1836, and up to the present time there has been expended on them, and on various other improvements in the Delta of Tanjore, perhaps ten lacks (£100,000) (besides the outlay for necessary repairs), and the Revenue has increased from forty-two to fifty-two lacks (from £420,000 to £520,000). The increase of value of land has been, so far as I have been able to ascertain, from about twenty rupees (£2) an acre, to forty or forty-five rupees (£4 to £4 10*s.*), making a difference on 700,000 acres, of at least one and a half million sterling; and I think this is below the actual present price. The result of this expenditure of ten lacks (£100,000) may therefore be thus calculated:—

Capital represented by an annual interest of £100,000 at 4 per cent.	$2\frac{1}{2}$ millions sterling.
Increased value of property.	$1\frac{1}{2}$ " "
Total...	4 millions sterling.

And the increase of value given to the land is yielding from 5 to 6 per cent. Thus this outlay of £100,000 has produced the interest of upwards of four millions sterling; or, the *value* of the water is more than forty times its *cost*. After many examinations of the case, I feel confident that this is a true calculation, and no exaggeration; and it remarkably agrees with the former calculations of the cost and value of water taken from other data.

Now if a community can purchase water at a certain price and sell it again in the shape of rice, sugar, indigo, tobacco, pulse, cotton, &c., in unlimited quantities for fifty times as much, one would suppose that the question, of how to make both ends meet, was settled. And such is undoubtedly the actual state of things in India. The prices of all exportable articles, whether rice or cotton, for instance, are equally made up of the cost of food and clothing. And if water be applied to diminish labour in raising articles of food, the portion of the population thereby set free will of course employ themselves in raising whatever their country is best suited to produce for foreign countries; and any amount of cotton and other things can be sold to Europe, China, &c.

Port Phillip has been loaded with wealth by discovering a thing which can be obtained at one-fourth of its value, while India continues poor with a thing which can be obtained at one-fiftieth of its value.* What is the difference between the two countries that produces such a strange anomaly? The sole reason is, that the P. Phillippians make use of their treasure, which the Indians, or rather their European rulers, do not. A man in P. Phillip, who could earn previously £40 a year on an average, went to the diggings and obtained in one year about £140 worth of gold. As soon as this was known, more than half the population were employed in digging gold, and last year they obtained about fourteen millions sterling. In India, supposing that at this moment twenty-five lacks (£250,000) a year are being spent on new Hydraulic works, we may calculate that about 60,000 people are so employed; or not more than $\frac{1}{2500}$th part of the population, and not a thousandth part of the proportion employed in P. Phillip, in securing the treasures there discovered.

Nothing therefore can be more evident than that it is not the having a treasure in the country that makes it rich, but the taking advantage of it. It was not the gold underground that made P. Phillip rich, since the people were none the better for it for many years; but rather the digging it up, and giving it in exchange for consumable things, &c. In the same way India will continue poor, even if water were ten times its present value, so long as it is not made use of, but still allowed to flow into the sea by millions of tons per second. The water that flows off in this way by the Godavery is sometimes as much as 4,000 million cubic yards per day, worth eighty lacks (£800,000), or three times the whole Revenue of Rajahmundry for a year; but till it is made use of, the country continues just the same as if it had no such treasure.

How strange it seems, that whilst the dullest labourer can perfectly understand the value of gold, the wisest statesman cannot perceive the value of that which is exchangeable for gold; so that though £100 worth of gold in the form of water can be obtained in India at a cost of only £2 10*s*., no Indian statesman has yet been found wise enough to set a thousandth part of the population at work to obtain it; whereas in P. Phillip, when it was discovered that £100 of gold could be obtained for £25 worth of labour, more than half the population were immediately employed in digging it up. Whenever this subject is started, the defence is, "but see what we are now doing; look at the Ganges canal, and the Godavery and Kistnah works." Suppose the P. Phillippians had continued as poor as they were, and upon somebody taunting them with neglecting their great treasure, they were to say in defence, "what shameful misrepresentations! out of our 60,000 people, we have got twelve people digging at Bullarat, and twelve at Mount Alexander";

* It has been estimated that every man employed at the diggings obtains, on an average, 50 oz. of gold, worth £140 a year.

what should we think of their sense and activity? And yet, twenty-four diggers bear the same proportion to the population of Port Phillip, as the 60,000 employed in Hydraulic works bear to the whole population of India.

Upon what imaginable principle is it then, that only certain parts of three or four districts out of 100, are to be thus improved? The objection of want of money has been shown over and over again to be without a vestige of foundation. Did the P. Phillippians wait till they were rich, before they went to the diggings? How many of those who traversed the country to reach the spots where this treasure was known to be, had any surplus cash? They went there because they were poor, not because they were rich. And the case is exactly the same in India. How much surplus Revenue has it taken to furnish Rajahmundry with Hydraulic works? While twenty lacks (£200,000) have been spent, thirty lacks (£300,000) have already been obtained in return. The same with Tanjore and to a still greater extent, for with an outlay of only Rs. 40,000 (£4,000) a year, a permanent increase of Revenue of two lacks (£20,000) a year was obtained; so that in ten years, four lacks (£40,000) had been paid, whilst twenty lacks (£200,000) had been received. How astonishing it is then, that in the face of these notorious facts, this plea of *want of money* should be continually advanced, just as if nobody knew of them. Suppose the Marquis of Tweedale, instead of having the Godavery works commenced some years since, had urged the Court to wait till the district yielded a surplus Revenue out of which they could be carried on, can there be a doubt that the district would have remained in its poverty for ever? And, on the other hand, how much better and more just would it have been to execute the new works by borrowed Capital, rather than to levy all this additional Revenue at once. This money, if left in the hands of the people, would have been laid out so as to yield 50 or 100 per cent., while only 4 per cent. would have been paid for the loan.

There is only one district in the whole Indian Empire (Tanjore) that has never, for more than fifty years past, caused the Government an anxious thought about finance; that has from the first up to the present time been a source of real satisfaction in this respect; about which nobody has ever had to say "how shall we make both ends meet?" and that has even provided, in its increase of Revenue, ten or twenty times its share of the war expenses of India. And this is the only district where money has throughout been spent in increasing the supply of water. Has this district in any one single year been a drain on the treasury? Has any one yet been heard to say, "these are certainly grand and profitable works, but how can we find money for them? no doubt at some future time they will pay well, but in the meantime what possible contrivance can we discover to enable us to provide the money?" Nothing of this sort has ever been thought of. The district itself has throughout provided the money for everything from year to year, and

an enormous surplus besides. And yet the moment it is proposed to do the same thing in the next district, it is said, "these ruinous wars keep us so poor that we cannot afford it; and not only that, we cannot even afford to have the old works kept in repair." For there is not a district in the Madras Presidency, except Tanjore, in which the old works are generally in good repair.*

It is not the ruinous wars then that have kept us poor, but the most unaccountable neglect; a neglect the more extraordinary, because it is not endured for a moment in other things. Let any man propose to provide money for wars, by leaving buildings to go to ruin, and he would be thought mad; and yet this is only what is systematically done with works upon which the food of the people and the Revenue depend.

India is like the field after an Indian battle; there is but one cry, "*water, water.*" All that is wanted is water; and this want supplied, everything else will almost follow of course. Water for irrigation, and water for transit, will provide for everything else. Water is the universal solvent, and can solve that which has puzzled all the Indian wise men, from Lord Cornwallis down to the present time, *viz.*, the Revenue Settlement question. *It has solved* that question in Tanjore, the only district where it has been tried. When a man has to pay only six rupees (12*s.*) a year for an acre of land saleable at forty-five rupees (£4 10*s.*), the question is substantially solved. There may of course be a thousand questions of secondary importance about that, as about everything else; but the essential difficulty is gone. The real difficulty all along has been this, how to get six rupees (12*s.*) of Revenue out of land on which the total profit was only five rupees (10*s.*), and nothing but water could solve this; and it will assuredly do the same in every district of India where it is applied, by the simple process of making the profit on the land ten or fifteen rupees (£1 or £1 10*s.*) per acre.

The total amount of treasure in the country, in the shape of water, may be thus calculated. If we allow on an average two feet of rain to run off the face of the country annually, then, after allowing for evaporation, there will still be two millions of cubic yards available per square mile, besides what falls on ground under cultivation, of which of course the profit is not lost. Thus the water that flows off every square mile is worth, at the rate of 500 cubic yards per rupee (2*s.*), Rs. 4,000 (£400) a year. The present population of India averages about 100 per square mile; but if the whole of the water that falls were made use of, no doubt the country would bear at least 400 to the square mile. The water then turned to account would be worth ten rupees (£1) a head per annum, and as there would be in all India 600 millions of people, the total value of the water would be 60,000 lacks a year, or 600 millions sterling.

* Just as in Rajahmundry, so in Tanjore, if it had been said, "we will wait till we have a surplus Revenue before we commence upon improvement," the district would have been without surplus Revenue to this day; and if money had been borrowed at once, to give the district a really complete system of works, it would have been ten times as rich as it now is.

Again, allowing that 7,500 cubic yards per acre would be sufficient for a rice crop, and 2,500 for what are called dry crops, (as above calculated), and that one-fourth of the country is cultivated with rice and three-fourths with other crops, it would take on an average 4,000 cubic yards per acre, which would allow of 500 acres being cultivated in every square mile, which is no doubt the proportion of the whole country that is fit for culture.

With the present population, one-fourth of the whole of this water might be turned to account, and by that means a clear additional income of 150 millions sterling, six times the whole present Revenue, would be obtained. Hence we see how utterly insignificant, as compared with its income, would be the cost of governing the country, provided only the same were done here that has been done in P. Phillip, that is, if the treasure we possess were made use of.*

Can anybody assign any reason why the same that has taken place in Tanjore should not take place in every district, if the same means were used? That district is yet by no means improved to the fullest extent, and yet the population has doubled within perhaps twenty-five years, and is now about 500 per square mile. Were water thus made use of generally throughout the country, the population would certainly increase as fast everywhere; the state of the people there has greatly improved in respect of their physical circumstances, and this also would be universal.

We may next examine more particularly into the state of the question, as respects the use of water for navigation. This involves the great question of the comparative value and importance of internal navigation and land communications, especially with reference to India. Not a single paper has yet been written about canals and railways in India that does not show a fundamental misapprehension of this subject. Universally, railways are spoken of as substitutes for canals, though nothing can be more false than this idea. Canals, as at present worked, even where steam is not used, are the cheapest of all communications; but railways afford the highest speed. There is not the slightest probability of railways ever beating canals in cheapness, nor of canals beating railways in speed. This at once reduces the question between the two works to this, which, in any particular circumstance, is most required, speed or cheapness? or, in other words, which is the most serious loss, that of time, or that of money in increased cost of transit? Or, again, is the time saved by a railway purchased at more than its real value, consid-

* Let us take a specific example of the effects of attention to Public Works, compared with those of economizing in expenditure. On roads near Madras, more than Rs. 30,000 (£3,000) a mile are paid for transit. A canal would cost, suppose even Rs. 20,000 (£2,000) a mile, or Rs. 800 (£80) a year for interest, and the same transit by it would cost Rs. 1,000 (£100) a mile, or there would be a saving of Rs. 29,000 (£2,900) a mile. If only half of this were charged as tolls, every two miles would provide the salary of a Collector or three Revenue subordinates, so that forty miles so improved, would provide for double the number of European Revenue men throughout the districts of the Madras Presidency.

ering the extra cost of transit? A very simple calculation will show that this may be the case. Suppose goods carried by a railway 1,000 miles in three days, at fourteen miles an hour; or the same distance by a steam-canal in fourteen days, at three miles an hour, night and day, so that the loss of time by the latter is eleven days. Now if these goods are of the value of £3 a ton, grain for instance, the loss in interest at 8 per cent. for eleven days, is fifteen pice (2*d.*), equal to one-seventieth of a pie ($\frac{1}{560}$*d.*) per ton per mile; and if the railway be worked at four pice ($\frac{1}{2}$*d.*) and the canal at one pie ($\frac{1}{8}$*d.*), it is clear that an addition of three pice ($\frac{3}{8}$*d.*) is paid for a benefit of the value of one-seventieth of a pie ($\frac{1}{560}$*d.*); or, we pay for our whistle two hundred times what it is worth. This is quite sufficient to show that railways are not *substitutes* for canals; and that to talk of these latter, as the substitution of a second-rate for a first-rate means of commercial intercourse, as is so universally done, is a complete mistake. It is exactly as if we should insist that no more carts should be built, because carriages had been invented.

Thus the question is an open one still, "Under such and such circumstances, what kind of communication is most suitable?"

Before going further, however, it will greatly help us in investigating this most important point, if we consider the more obvious oversights clearly observable, in the mode in which this subject has hitherto been treated.

1st. All our ideas on the question are based upon the two kinds of works as seen in existence in England; and thus, we compare canals constructed at a cost of £10,000 a mile, before steam and the value of time were discovered, with railways costing £45,000 a mile, and arranged to be worked by steam and to economize time to the utmost. But how does this settle the question between two systems of communication, in both of which the power of steam would of course be adopted?

In England, moreover, the only canals at present in existence, are winding ones fitted with confined locks, which take a long time to fill and empty, are often closed for weeks by frost, and always worked at two or three miles an hour by horse-power. And yet with all these enormous disadvantages, are railways in England a substitute for the canals? Not at all. All the great lines of canal are in full operation to this day, and are, I believe, without exception, yielding much larger profits on their cost than any railways. What is the actual amount of traffic on most of the English canals, I have not the means of ascertaining; but on the Manchester and Liverpool canals, it is two millions of tons a year, and on the Grand Junction canal 1,100,000 tons; and when we see, by Lardner's Treatise, that the goods traffic on the railways varies from sixty-eight to 631 tons a day, it is quite certain that the great bulk of goods must be still carried by the canals. And when it is considered, that railways, although having the prodigious advantage of steam-power in their

favour, yet carry so small a proportion of the traffic, nothing can be more evident, than that railways cannot be *substitutes* for canals.

If we want fully to compare railways and canals, we should consider how the case would stand even in England, if a new canal, perfectly suited to the use of steam-powers, were now cut. I will not take the cost at £45,000 a mile, like the great railways, (or four and a half times the actual cost of a canal), but at £20,000 or £30,000 a mile, the canal with few windings, and with capacious locks capable of being filled and emptied in a few seconds, and of being navigated by screw steamers of 300 tons or of 300 horse-power for passengers; and we should then see a real comparison between these two classes of communication in England. It seems almost certain, that a railway on the same line as such a canal, would not obtain employment enough to pay one-tenth of the interest of its cost, because passengers could be conveyed by the canal at fifteen or twenty miles an hour, and the great mass would be conveyed with a speed of ten or twelve miles an hour at so very low a cost, as to leave probably only the very highest class of passengers for the railway, whilst goods would be carried at such a speed as would best suit each kind.

Thus in comparing canals and railways, we take our ideas only from the state of things in England, where there is steam-power on one side and animal-power on the other, besides many other disadvantages in the canals, such as frost, a very winding course, locks very slowly filled, &c., which are by no means a necessary part of a system of inland navigation, and would not be met with here.

2nd. We have lost sight of the effect of long distances upon transit. In England, (according to Dr. Lardner), goods in general are carried on an average by railway a distance of not more than twenty-two and a half miles, and there, of course, cheapness forms a far less important item than in a country where goods are carried from 100 to 1,000 miles; but even there, cheapness is so far important, that, as we have already seen, the great mass of goods is carried by the cheapest means of communication, although at a low speed. In America and India, however, all other points are comparatively insignificant as compared with cheapness. In England, a thing worth £40 a ton is carried the average distance of twenty-two and a half miles at the rate of 2*d*. per ton per mile, whereby only 3*s*. 9*d*., or less than half per cent., is added to its value; and if conveyed at 1*d*. a mile, the addition would be only £1 in £400. But if in India, an article worth £10 (a high value for the common articles of traffic here) be carried 500 miles at 2*d*. per mile, more than £4, or 40 per cent., is at once added to its cost; and if carried 1,000 miles £8, or 80 per cent. Even if it could be carried at 1*d*. a mile, there would still be an addition of from £2 to £4, or from 20 or 40 per cent., to the first cost; and as a difference of one-fourth per cent. often makes a great difference in the demand for an article, the reduction of even one-tenth part of the above twenty or forty per cent. may easily make the difference of

a vast demand for an article, or none at all. And hence we see, that although this question were finally settled in England, that would by no means close it as regards India, even if there were only this one point of difference.

3rd. The question has never been discussed in England, whether railways or canals should be constructed there, as the main means of communication. The question there was, *whether railways should be added to other existing means of communication*; and therefore the two cases are totally different. The country was already provided with a complete system of *cheap* communications, and the only question was, whether it could afford to *add* to them a system of costly high speed communications. England could much better do without its railways than without its canals; *for if the canals were destroyed, the railways could not, in their present state, carry on the amount of traffic which is indispensable.* If the high speed trains were continued, then, in order to accommodate the mass of traffic now carried by canals, additional lines of rails must be laid down at a far greater outlay both in Capital and current expenses, than the previous cost of construction.

Hence again, even though it were clearly proved that people were right in adding railways to canals in England, this does not decide the question, whether in a country without either roads or canals, we should first construct railways.

4th. The large amount of traffic to be provided for in India, has been totally lost sight of. The busiest railway in England only carries 630 tons a day, the ten principal ones on an average only 288 tons, and the average of the whole is probably not as much as 200 tons a day. How then can this settle the question for a traffic of 7,000 tons a day, (like that on the line from Calcutta to the interior), which will undoubtedly increase to 20,000 tons, when the country is improved, as it now soon will be. We might as well say, that because my Lord and his Lady find a carriage sufficient to carry their own persons, therefore all the farmers on the estate ought to carry their hundreds of tons of goods in a gentleman's carriage, instead of in wagons. It by no means follows, that because railways answer for such comparatively insignificant traffic as that conveyed by them in England, that means of communication would therefore be sufficient or suitable for the enormous traffic of India, even in its present paralyzed state. But it does *not* answer even in England; for while 180,000 tons are carried between Manchester and Liverpool by the railway, two millions of tons are carried by the canal on the same line. It is quite clear, that if a double railway had to convey 100 trains a day of 100 tons each, they must at least all go at one speed, and I suppose it would be found absolutely necessary, in order to allow of the necessary repairs being made, to have a third way; so that if fast trains were also to be used, the railway must have five pairs of rails, which, in England, would cost on an average £100,000 per mile. But if we only

consider what would be the effects of occasional accidents on a line worked by 100 trains, it appears more probable that a railway, with even five pairs of rails, could not anything like perform the work of a line of traffic of 10,000 tons a day, besides quick passenger transit.

The question therefore still remains open, "What kind of communication is best, for a country with such an enormous traffic as we have to expect and provide for in India?"

5th. In England, the time occupied in constructing was a comparatively unimportant consideration. Up to this time perhaps 7,000 miles, including a great length of secondary lines, have been constructed; and in the meanwhile the country had the use of a complete system of common turnpike roads and canals, (about 100,000 miles of the former and 5,000 miles of the latter, I believe), besides sea and river communication within fifty or sixty miles of every point in the country. But, in India, we want at least 20,000 miles of main and 100,000 of secondary lines, or fifteen times the length required in England; and have, in the meantime, no cheap and moderately expeditious means of transit, excepting one single internal line (that of the Ganges) and the Coast line of the Peninsula.

The question of the *quickest mode of opening out communications*, is therefore a vital one to India.

It is not like the railway question in England, which was merely the introduction of a great improvement, when the main interests of traffic were already substantially provided for. Rapidity in the execution of a system of communications, is here the great fundamental point of the whole question: twenty years were occupied in laying down the principal railways in England; but as India cannot afford to be 300 years in providing herself with the corresponding 120,000 miles of communication she requires, India *must* find some more expeditious way of proceeding.

6th. England had no internal facilities of any importance for forming internal water communications, having only a few short lines of improvable rivers. India, on the other hand, has a vast extent of rivers capable of being made perfectly available for steam navigation throughout the year, at a cost not exceeding one-fiftieth of what railways will cost; and consequently capable of being brought into use, in at most one-fiftieth part of the time that it would take to execute the same extent of railway. Thus we have on several lines the choice between opening in one year 300 miles at a cost of Rs. 1,000 (£100) per mile, by improving a river; and constructing a railway in twenty years, at suppose Rs. 50,000 (£5,000) a mile. The *most* important lines can all be opened at once by the former trifling expenditure of time and money. What madness then to throw away our immense natural advantages, merely because another country was compelled, for want of such advantages, to incur enormous loss of time and money!

7th. The false impressions respecting canals, as compared with railways, have arisen in part at least, from what, upon a little further

enquiry, proves to be one of the strongest things in their favour, namely, the alarm or actual loss of canal proprietors in consequence of the competition of the railways. What placed them in this predicament was the enormous profits on the canals, some of which, I believe, yielded 20 per cent. or more upon their original cost, and in consequence their saleable value rose to four or five times that cost. Thus the modern shareholders paid perhaps £1,000 for a share which originally cost £200, and it was necessary, in order for them to get 4 per cent. for their Capital, that the canal should yield 20 per cent. upon its cost. Of course, a concern in such a predicament, was in danger from any new competing work; and a new canal would have ruined the shareholders as effectually as a railway. When the profits on a work are great, the market value of shares corresponds, and if a work which cost £10,000 a mile, has to provide interest for £50,000, it must needs contend at a tremendous disadvantage with a new work which has only to provide a profit on its actual cost. The abstraction of a small proportion of the traffic may easily reduce the profit to the present shareholders below that of the national interest of money; or, they may be deprived of half their income, while still the great mass of the traffic is conveyed by the canal, and the profits of the work are, say 10 per cent., on its actual cost. The mere fact therefore of a new work injuring the property in the other, or even ruining the owners, proves nothing as to the superiority of one to the other. A steam-canal worked at twenty miles an hour at $\frac{1}{4}d.$ a head per mile for passengers, and at $\frac{1}{4}d.$ a ton for goods, would effectually ruin any railway in England that it competed with.

8th. The settlement of the question between railways and water communications in England would not tend to decide anything here, for another century at least, on account of the difference in the nature of the surface of the country. Wherever the variations of level are great, the advantage is proportionably in favour of the construction of railways, as compared with canals. But there can be no comparison between the surface of the country in England and that in India, the amount of work required on a given length of communication in India being probably not one-tenth of what it is in England, taking the main portion of India. Hence on many lines a canal may be almost as straight as a railway, and the labour of constructing a steam-canal altogether would not be more than that of preparing a line for rails. On many lines therefore a steam-canal could be made for a tenth of what a railway would cost.

It must be observed, that all these remarks refer to *high speed* railways, such as are now talked of for India, and are under construction.

9th. In England the comparative cost of earth, masonry, &c., as well as iron and machinery, is so totally different from the same in India, that a conclusion reached by means of data obtained in the former country, cannot be trusted to for India. Supposing rails to cost, in Eng-

land, £6 per ton, and earth 1s. per cubic yard, whilst in India the latter cost 1*d.* and the former £8, it is very evident that, although in England the cost of a canal may be one-fourth of that of a railroad, in India it may cost only one-tenth, even without making any allowance for the difference in the surface of the country.

We may thus sum up the points which have hitherto been lost sight of or misapprehended, with reference to the use of water communications in India:—

1st. Effects of the application of steam:

2nd. Extent of country for which means of transit must be provided:

3rd. Railways, not as the only communications, but as an *addition* to a system of cheap water transit:

4th. Amount of traffic to be carried:

5th. Importance of time occupied in constructing a system of communications:

6th. Facilities for internal navigation in India:

7th. Original cost of canals in England as compared with present value:

8th. Comparative nature of the surface of the country in India and England:

9th. Comparative cost of iron, &c., and of labour, in India and England, respectively.

We thus find, that the state of things in England affords no data for the decision of the question respecting the comparative advantages of land or water communications in India, at least in regard to most of its fundamental points; and, consequently, if we trust to our preconceived notions in this case, we shall most assuredly draw wrong conclusions. In the first place, there are no steam water communications of any consequence in England. There are such, however, both natural and artificial, in America; 160 miles, for instance, on the Hudson, from Albany to New York, and Mr. Mackay informs us,* that on this line, a barrel of flour is conveyed for 2*d.*, including landing charges, &c., which is equivalent to $\frac{1}{7}$*d.*, a little more than one pie per ton per mile. And if this can be done in America with the low value of money there, it could certainly be done in India for one-fourth of a pie, or $\frac{1}{32}$*d.* per ton per mile. Now compare this with the proposed railway rates in India, varying from 1*d.* (eight pice) to 2$\frac{3}{4}$*d.* (two annas nearly) per ton per mile, and the great difference will at once be made clear. As regards speed, the Hudson line is regularly worked at eighteen and twenty miles an hour, with steamers drawing four feet; and there is no doubt that this speed will go on increasing. Thus we have an actual case of inland steam navigation, with a very small depth of water, a speed of eighteen or twenty miles an hour, and a charge for goods corresponding with one-fourth of a pie ($\frac{1}{32}$*d.*) per ton per mile in India. The common charge, too, for first class passen-

* *Vide* Mackay's "*Western World.*"

gers is half a dollar, or one rupee per head per mile, equal to one and a quarter pice ($\frac{1}{8}d.$) in India. Can any man be found to deny that such a communication would be immeasurably more valuable for India than one on which the very few first class passengers could travel at forty miles an hour, but on which the great mass of travellers and the whole amount of goods must pay ten or twenty times as much as need be charged on a navigation line?

Again, Mr. Ellet states, that goods are sometimes carried on the Mississipi at one pie ($\frac{1}{8}d.$) per ton per mile; and although he does not state the general rate, it would doubtless not be much more than that.

Of artificial steam navigations, we have that of the St. Lawrence and its canals. On this line, (according to Mr. Mackay), the charge is 2*s.* 4*d.* for a barrel of flour of 200 lbs. carried 650 miles, which gives four pice ($\frac{1}{2}d.$) per ton per mile (including canal dues); and he also states, that after some further improvements, this charge will be reduced to about two and a half pice ($\frac{1}{3}d.$) per ton. This traffic is carried on by 300 ton screw steamers at an average rate of six and a half miles an hour, night and day, including stoppages. The above charge corresponds with about half a pie in India, or even less, allowing for the difference in the value of money; and at a speed of three miles an hour, the cost would not be half that.

Thus we have undeniable proofs, upon the unexceptionable authority of Mr. Mackay, of the value of inland steam navigation, both with respect to the grand fundamental desideratum in transit, *cheapness*, and also with respect to speed. But even were it otherwise as regards speed, it is most certain that, in the present state of India, no speed in the world could make amends for the cost of transit of goods being increased eight or ten-fold.

We have, next from the same authority, some account of the navigation by the Erie canal, from lake Erie to Albany on the Hudson (365 miles) worked by horses. This canal was first cut in 1822 at a cost of about seven million dollars (150 lacks, or one and a half million sterling); and in 1840, (ten years after the value of railways was clearly seen), its enlargement was commenced and carried out at a further cost of twenty-four million dollars, so that its total cost has been thirty-one million dollars (700 lacks, or seven millions sterling,) on the whole; or about Rs. 180,000 (£18,000) a mile. Lardner, in his account, makes the cost Rs. 137,000 (£13,700) a mile, and the average cost of railways in the States is given by the same authority at Rs. 81,000 (£8,100) a mile; so that even after the effects of railways were fully known, and several thousand miles had been constructed in the States, it was not thought a mistake to enlarge a canal, by spending on it three times its original cost, making a total per mile of more than one and a half times the cost of railway; and that, too, in a country where *frost stops water communication for five months in every year.*

In a chapter entirely devoted to the subject of the transit between the upper valley of the Mississipi and the Atlantic, in which Mr. Mackay describes the struggle between the States and Canada to secure its passing through each of those countries, *railways are never once mentioned;* a highly significant fact in connection with this investigation. The fact is, that railways do not, in the slightest degree, affect the question. Their usual charge for goods is $1\frac{1}{2}d.$ (one anna) per ton, and even though they have the immense advantage of being open all the year round, while canals (in America) are only open for seven months, the whole question still turns upon the comparative advantages of the two lines of *navigation;* and Mr. Mackay shows, that Canada having steam-power, the other has no chance with it. Dr. Lardner states, that it was in contemplation, when he wrote, again to enlarge this canal, in order to allow of the use of steamers on it, so that it will probably eventually cost much more than treble the railroads in America, and this after the fullest experience of the two kinds of communication. This leaves no room whatever for doubt, that it is a complete mistake to look upon a canal as universally and simply a second-rate means of communication, which ought never to be substituted for a first-rate one, like a railway. Here is an actual case, where there cannot be the smallest question of the superiority over a railway, of a steam-canal, or even one worked by horses, and where the railway is constructed, not as a substitute, but as an addition; and *that* no doubt chiefly on account of the canal having been hitherto worked at only three miles an hour by horses, and being entirely stopped for five months in the year. The cost of transit on the Erie canal line is stated to be (including tolls) $\frac{9}{10}d.$ (seven pice) per ton per mile, which (considering the difference in the value of money) corresponds with about $\frac{1}{5}d.$ (one and a half pice) in India; but as interest on so large a sum as Rs. 137,000 (£13,700) a mile, is provided out of this, at $5\frac{1}{2}$ per cent., and by a traffic confined to seven months in the year, the actual cost of draft can be only a small part of the whole charge.

In speaking of the railways in the States, Dr. Lardner says, "*But little merchandise is transported by them, the cost of transit by them being greater than goods in general are capable of paying.*" And in his tables he shows, that the average distance that goods are carried by rail, is thirty-eight miles, clearly proving, that the great mass of the distant traffic is scarcely touched by railways, although they exist on many lines where there is no water communication. The real fact is, *where goods cannot be carried by water, they are not carried at all except for very short distances.* Let this be well considered in investigating the subject of communications for India. Dr. Lardner gives the average charge for goods in America at $1\frac{3}{4}d.$ per ton, corresponding with about $\frac{3}{8}d.$ (three pice) per ton in India; and *this cost is sufficient to prevent distant traffic.* Dr. Lardner says also, in regard to the Hudson navigation carried on in steamers drawing at most only four and a half feet, "when

the splendour and magnitude of the accommodation is considered, the cheapness of the table, &c., it will be admitted that no similar example of cheap locomotion can be found in any part of the world. Passengers may there be transported in a floating palace, surrounded with all the conveniences and luxuries of the most splendid hotel, at the rate of twenty miles an hour, at $\frac{1}{5}d.$ per head per mile, corresponding with about one-sixth of a pie in India." Now if there were a line of steam-canals in India, suited to steamers drawing four and a half feet, worked at twenty miles an hour for passengers, at a charge of one-sixth of a pie ($\frac{1}{48}d.$) per head, and conveying goods at one-fifth of a pie ($\frac{1}{40}d.$) per ton per mile, how much traffic would be left for a railway on the same line?

The following table, extracted from the Report of the Select Committee of the House of Commons on railways and canals, will show how far the railways are, even in England, *substitutes* for canals:—

Statement of the traffic by water between Manchester and Liverpool, from the year 1839 to 1852 inclusive; and by railway, from the year 1838 to 1848 inclusive.

Year.	Gross Total by the Bridge-water canal, and by the Mersey and Irwell navigation.	By Railway.
1839	318,894	
1840	338,300	164,625
1841	323,860	
1842	327,819	Average.
1843	413,005	
1844	429,742	190,914
1845	464,710	200,239
1846	498,028	217,416
1847	413,781	191,144
1848	429,937	181,968
1849	478,644	
1850	413,583	
1851	349,718	
1852	318,904	

Statement of the gross traffic on the navigation of the Bridgewater Trustees, inclusive of the Staffordshire trade.

Year.	Total.
1839	1,174,214 Tons.
1840	1,228,234 "
1841	1,169,522 "
1842	1,161,250 "
1843	1,272,567 "
1844	1,537,547 "
1845	1,750,939 "
1846	1,823,811 "
1847	1,744,179 "
1848	1,608,223 "
1849	1,939,935 "
1850	1,910,247 "
1851	1,900,926 "
1852	1,980,266 "

Here we see that after several years' competition, notwithstanding the enormous power of the Railway Companies from the immense Capital under the management of a single body, notwithstanding the prodigious advantage possessed by railways over canals in being originally constructed for *steam-power* instead of for *animal-power* only, notwithstanding the very low rate of speed on the canals, their being annually closed by frost for several months, and their being divided under so many different Companies, and finally, notwithstanding that some of the railways have been allowed to get possession of certain canals, forming links of an extended chain of communication—yet, by far the greater mass of the traffic is still carried on by the canals. The Manchester and Liverpool canals carry two million tons a year, or more than 6,000 tons a day,

and the Grand Junction canal carries 1,110,000 tons a year, or 3,600 tons a day; whilst, according to Dr. Lardner, the most crowded railway in England does not carry 700 tons a day. If this be the case in a country where the distances are very small, so that the cost of transit is a small item, and where the value of goods is great, what must be the case in India, where distances are ten times as great, and where the goods are perhaps only one-tenth the value of those in England?

We may further judge of what inland steam navigation may be, from the statement of the expenses, &c., of the Austrian Lloyd's Company's Mediterranean fleet for 1852-53.

The expenses of their whole fleet of fifty-eight vessels, for the year, while running 580,000 miles, was as follows:—

	Florins or Rupees.	Pounds Sterling.
Pay, victualling, fuel and expenses, &c.	21,00,000	(£210,000)
Administration	3,00,000	(30,000)
Depreciation of vessels	70,000	(7,000)
Rs.	24,70,000	(£247,000)
Dividend at 8 per cent	2,40,000	(24,000)
Rs.	27,10,000	(£271,000)

This, divided over 580,000 miles, gives four and two-thirds rupees (9*s*. 4*d*.) per mile per vessel, which, allowing four to one for the difference in the value of money in the Mediterranean and in India, is equivalent to one and a quarter rupees (2*s*. 6*d*.) per mile in the latter, including profit at 8 per cent.

The sum of Rs. 2,40,000 (£24,000) being interest at 8 per cent., implies a Capital of thirty lacks (£300,000), or about Rs. 50,000 (£5,000), for the cost of each vessel, which may therefore probably average 100 horse-power and 300 tons.

The cost per horse-power per mile will then be,

$\frac{4\frac{2}{3}}{100}$ rupees = nine pice ($1\frac{1}{8}d.$) equivalent to two and a quarter pice ($3\frac{1}{4}d.$) in India.

And the cost per ton of vessel per mile is,

$\frac{4\frac{2}{3}}{300}$ rupees = three pice ($\frac{3}{8}d.$) equivalent to three-fourths of a pie ($\frac{1}{11}d.$) in India.

And this being the actual expense of working ocean steamers, which, allowing for the difference of vessel and engines, the difference in the wear and tear, and other contingent expenses, must certainly be double that of working vessels of the same size and speed on inland waters, we may arrive at the conclusion, that such vessels could be worked inland, at the rate of ten or twelve land miles per hour, at ten annas (1*s*. 3*d*.) per mile.

This will give a very clear idea of the difference that water communication by steam-power would make in India; a vessel of 300 tons and 100 horse-power going at the rate of ten miles an hour, costing exactly the same as two palanquins, or four bullock bandies. If there were such a communication from Madras through Tanjore and Trichinopoly, (to which there is not the least obstacle), a gentleman and his wife might hire a whole steamer of 300 tons, and reach the foot of the Neilgherry Hills in forty hours, for the same money that they now pay to go there by palanquin in eight days. Or, if content with merely a cabin to themselves, supposing there were only twenty first class passengers, who paid one-fourth of the total expenses, (the rest being paid by second class passengers and goods), they would have to pay only one and a half pice ($\frac{1}{5}$*d.*) a mile each, or six rupees (12*s.*) for both for the whole distance, instead of Rs. 250 (£25), as at present, by palanquin.

And supposing the merchant who had to send 300 tons of goods to Madras, paid half the hire of the vessel, (the rest being paid by passengers), the goods would be charged at the rate of only one-fifth of a pie ($\frac{1}{40}$*d.*) per ton per mile, or eleven annas (1*s.* 4$\frac{1}{2}$*d.*) per ton for the whole distance, making a total of only Rs. 200 (£20) for the whole 300 tons conveyed to Madras in forty hours, instead of, as at present, paying the hire of 600 bandies, at one anna (1$\frac{1}{2}$*d.*) a mile each, total Rs. 15,000 (£1,500), to have it conveyed to the port in thirty days, with much risk; so that what is now an unprofitable venture to a merchant, would, with the steam-canal, give him a profit of £1,480, that being the amount saved on the carriage alone.

From such calculations as these, based on unimpeachable data, one cannot but see what India is losing for want of cheap water communications.

It is remarkable how the above calculation from ocean steamers on an extensive scale, agrees with the actual cost of working a twenty-horse-power steam-tug on the Godavery, *viz.*, four annas (6*d.*) per mile, or three pice ($\frac{1}{3}$*d.*) per horse-power per mile, just the cost of the ocean steamers, after allowing for the difference in the value of money, *viz.*, four to one; the small vessels on inland waters thus costing the same per horse-power as the large vessels at sea.

Such a steam-canal could certainly be cut on the line above mentioned, *viz.*, from Madras to the Western Coast through Coimbatore, at a cost of Rs. 15,000 (£1,500) per mile, making the most liberal estimate.

Now let us suppose instead, a high speed railway with double lines of rails, (which would be absolutely necessary to accommodate the traffic), costing Rs. 70,000 (£7,000) per mile, and allowing that it were worked at half the lowest rate estimated by the railway men, *viz.*, four pice ($\frac{1}{2}$*d.*) per mile, or twenty times the cost of working the canal, can there be any doubt which should be selected? Ask the merchant which he would prefer, to go up to Coimbatore by canal in twenty hours, travel-

ling at the rate of fifteen or twenty miles an hour, and send his goods back at eleven annas (1*s.* 4½*d.*) a ton, or to travel himself by the railroad in ten hours, and then send his goods back at fifty rupees (£5) a ton. And this, too, being only obtained by an outlay of 280 lacks (£2,800,000) for the railway, whilst eighty lacks (£800,000) would suffice for the canal.

We find therefore abundance of undeniable data which leaves no possible room to question the suitableness of water communication to this, and indeed, all other countries, or its immeasurable superiority to any other means, at least until a country can afford to *add* communications giving a still higher speed. Moreover, we are not yet at the limit of speed by water; it has already exceeded twenty miles an hour in four and a half feet water, and nothing is more certain than that it will go on increasing. The vessels on the Hudson, for instance, have attained a speed of twenty-two miles an hour, and would easily carry a second engine as large as the first, and then run at about twenty-seven miles an hour. And from the lately published accounts of the screw, it appears almost certain, that the same power of engine, working screws instead of paddles, would give a much higher speed, probably at least thirty miles an hour, *or half as much again as the present average speed of the American railways.*

It must not be forgotten, that now, after twenty years' experience, it is fully ascertained that, as a *speculation*, the high speed railways have totally failed, even in England. It has been stated by one of the best informed Engineers in England, that the real profits on all the railways do not average more than 1½ per cent. I do not at all mean to give it as my opinion, that the system of high speed railways has, on the whole, been a loss to the country: I believe that in a country in the present state of England, speed up to perhaps twenty miles an hour, is worth almost any money; but it is quite certain now, that the cost of the very high speeds of English railways has hitherto been quite under-estimated.

Let us again suppose the river navigation here to be improved to the utmost, so as to make all rivers with a fall of two or three feet a mile and under, as complete lines of navigation as possible. I have before reckoned that a stream of one million cubic yards an hour would secure a depth of three or four feet everywhere in the Godavery, and that tanks containing 3,000 millions of cubic yards, would be ample for this purpose, and would cost about fifteen lacks (£150,000). If treble this quantity were stored, so as to give a depth of full six feet in the river, and if the bed were perfectly cleared of rocks, so as to allow of the freest passage for steamers, then vessels of any power might be used, and I have little doubt, that if the rivers are kept at this regulated depth, excepting during the freshes, they could be worked by night, as well as by day; and if very high speeds were required, a mean current of, suppose two miles an hour, would be no obstacle to such vessels as would be

worked. A vessel, with a speed of twenty miles an hour, for instance, would go up at the rate of eighteen, and come down at twenty-two miles an hour. Now the cost of storing 9,000 millions of cubic yards of water might be forty-five lacks (£450,000); and allowing five lacks (£50,000) to be spent on the bed of the river, &c., we should have half a million sterling as the cost of at least 700 miles of inland river navigation,* besides making the branch rivers available for small vessels to a much higher point, which would be an outlay at the rate of only Rs. 7,000 (£700) per mile against Rs. 15,000 (£1,500) per mile for a steam-canal, or Rs. 70,000 (£7,000) for a railway. And it would have this vast advantage, that in the very first year the river would be available throughout, and each year the whole navigation would be improved to the full extent of the amount expended. This is precisely what India wants, *viz.*, to have whole lines of transit at once improved to a certain extent. If a high speed railway were laid on this line, it would be many years before the cotton country would be really accessible, and, in the meantime, at least ten times the whole cost of the work would be lost for want of means of transit; whereas, five lacks (£50,000), laid out on the river, would, in the first year, provide a thoroughly good and exceedingly cheap communication from the heart of Berar to the Coast, while the same sum, laid out on even a single line of high speed railway, would provide for only perhaps thirty miles out of the 400 required, and if only 100,000 tons were carried per annum, there would be a loss of fifty lacks (half a million sterling) for every year that the opening of the communication was delayed.

This shows the real state of the case as regards the Bombay railway and the Godavery navigation. To reach the centre of the cotton country will require about 400 miles of railway. What has already been done, has been at the rate of ten miles a year, and Rs. 70,000 (£7,000) a mile; and, continuing at the same rate, we should, if it were not for those plaguy ghauts, reach the Wurdah in forty years, after spending about 280 lacks (£2,800,000) on the line; and allowing only a traffic of 100,000 tons a year for half the time, or twenty years, at sixty rupees (£6) per ton, there would be an outlay of 1,300 lacks (£13,000,000) on transit alone. And the account would stand thus at the end of forty years, even supposing the trade did not increase on the Godavery, and that goods were carried for nothing by the railroad.

RAILWAY.

400 miles at Rs. 70,000 (£7,000)	280 lacks	(£ 2,800,000)
100,000 tons per annum for twenty years at sixty rupees (£6) per ton	1,200 „	(£12,000,000)
Total expenditure ...	1,480 lacks	(£14,800,000)

* Including the branch rivers.

GODAVERY.

Improving river so as to give a constant depth of six feet	50	lacks	(£ 500,000)
100,000 tons for forty years at three rupees per ton	120	„	(£1,200,000)
Total expenditure ...	170	lacks	(£1,700,000)

But the railways expect to be able to carry goods at one and three-quarter annas ($2\frac{1}{2}d.$) per ton, which for 400 miles would be forty rupees (£4) per ton, or two-thirds of what it now is, in which case 800 lacks (£8,000,000) more must be placed against the railway, making the expenditure on that line 2,300 lacks (twenty-three millions sterling) against 170 lacks (one and three-quarter millions sterling) by the river, or, thirteen times as much as the latter. Even allowing the railway to be worked for nothing, there would still be a difference of 1,300 lacks (thirteen millions sterling) in favour of the river.

And this, too, supposes that the river traffic would *not* increase, whereas if carried at five rupees (10*s.*) per ton, it would probably, before ten years were over, increase to 500,000 tons a year; and were the river improved to the extent above proposed, the rate of transit would not exceed three rupees (6*s.*) per ton.

Even if we suppose the ghauts to cause no delay in the railway, and that it be henceforward carried on at three times the rate hitherto, that is, at a cost of about twenty lacks (£200,000) a year, (a large extent of operation for India, corresponding with £1,200,000 in England), still it will take no less than thirteen years to reach the centre of the cotton country. And if we allow that the railway is worked at one-fifth of the sum at present calculated by the railway men, or four pice ($\frac{1}{2}d.$) per ton per mile, equal to eight rupees (16*s.*) for the whole distance, whilst the Godavery is worked at from five rupees (10*s.*) gradually diminishing as it is improved to one rupee (2*s.*), or at an average on the whole of three rupees (6*s.*) per ton per mile, then the account for the thirteen years would stand thus :—

RAILWAY.

400 miles at Rs. 70,000 (£7,000)	280	lacks	(£2,800,000)
100,000 tons a year for six and a half years, carried by common road at sixty rupees (£6) per ton	390	„	(£3,900,000)
100,000 tons a year for six and a half years carried by railway at eight rupees (16*s.*) per ton	52	„	(£ 520,000)
Total expenditure...	722	lacks	(£7,220,000)

GODAVERY.

Improving river	50 lacks	(£ 500,000)
100,000 tons a year for thirteen years carried by river at three rupees (6*s.*) per ton.	39 ,,	(£ 390,000)
Total expenditure....	89 lacks	(£ 890,000)
Saving by Godavery ...	633 lacks	(£6,330,000)

But besides this, the traffic on the Godavery may be reckoned to increase by that time to 500,000 tons a year, while that on the railroad, being carried at eight times the cost, would certainly not have increased in proportion beyond 200,000 tons. So that, after losing at least 630 lacks (six and a quarter millions sterling), we should be left, in the one case, with a traffic of 200,000 tons, carried to the Coast at eight rupees (16*s.*) per ton, and, in the other, with a traffic of 500,000 tons, carried at one rupee (2*s.*) per ton; the extreme rate of transit by railway being perhaps forty miles an hour against twenty by the river. I think this may fairly be considered paying too dearly for an additional speed of twenty miles an hour for the very small proportion of passengers, to whom this would be an object worth mentioning; and I suspect, that even those who advocate a high speed, would, when it came to the point, rather go at twenty miles an hour than pay the difference of cost for speed.

This also entirely leaves out of view the extremely important point, that by the Godavery, Berar can be supplied with food from Rajahmundry at one-fourth of the present cost; an advantage on the side of the river line, which it would not be easy to over-estimate. This would give a further stimulus to the cotton cultivation almost equal to that caused by the cheap transit; and thus, at the end of five years, when the railway would not yet have reached up half-way to Berar (even allowing it to proceed three times as fast as hitherto), the Godavery would have been a line of immense traffic for four years, every one of which would much more than pay for the whole cost of making it a six feet navigation.

One would suppose that nothing could be more obvious, than that a country, lying just half-way between two Coasts, with, on the one side, a river already navigable for six or eight months in the year, (a longer line than the Erie canal, upon which the Americans have spent seven millions sterling, or Rs. 180,000 (£18,000) a mile), and, on the other, a line of ghauts 3,000 feet high, which render a railway a very difficult undertaking, should first be connected with the port to which the river flows, by making that navigation available, rather than with the other Coast by means of an expensive railway. But men can only hold one idea at a time; and if their minds are already occupied with that of a railway, it is impossible to force in that of a navigation too.

If we could only have a ship-load of East India Directors, Manchester Merchants, Indian Reformers, and others interested in this matter, landed

at Bombay, carried twenty miles by the railway, and then on horses and in palanquins, 300 miles to the Wurdah, (a journey of from ten to twenty days), at an expense of Rs. 100 (£10) each; and on arriving there, placed in a steamer and floated down to Coringa in thirty or forty hours, for one rupee (2*s.*) each, then they would probably return to England with a more correct notion of the real state of the case; particularly as on the way up, they would have met with thousands of worn-out bullocks and drivers, carrying cotton at the rate of ten miles a day, and a cost of sixty rupees (£6) per ton, whilst in the boats in which they descended the river, there would probably be 100 tons of cotton on freight at five rupees (10*s.*) a ton. Reaching the end of the railway, after a journey of twenty miles, when it had already been two years in progress, and then seeing the frowning ghauts immediately before them, would also be a highly instructive circumstance that would tend greatly to clear their sight; and there would also be plenty of time for true impressions to be received, while on their long weary journey of ten or twenty days to the Wurdah, through a country without roads, and across rivers without bridges. What a lively idea they would have of the advantage of inland steam navigation, long before they reached the Wurdah, and with what entire satisfaction would they resign themselves to the sofas in the steamer, and consider themselves as good as at their journey's end.

I should mention that the river runs through, or near, forest country all the way, so that firewood could be obtained everywhere at the bank of the river, at eight annas (1*s.*) per ton, (equivalent to about one and a quarter rupees (2*s.* 6*d.*) for coal) or less; so that a 100 horse-power steamer would cost about three annas ($4\frac{1}{2}d.$) for fuel per mile going up-stream, and she would never have to carry a large quantity. Coal also has been found at two spots, and it is supposed to exist at a third, which the Natives have hitherto contrived to conceal from Europeans.

Besides the effects on navigation and irrigation, already mentioned as resulting from thus storing water in tanks, other points will be gained. First, 3,000 million cubic yards retained in the tanks would lower the water of the Godavery in the Delta during floods, one foot for 500 hours, or twenty-one days; and as the floods never continue at their highest more than eight or ten days, these tanks would probably keep the river a foot lower than otherwise on such occasions, which would greatly diminish the danger to the embankments, and the extent of mischief in case of breaches. A further value would be given to the water by its use for water-power in the Delta; after entering the minor irrigating channels, it will fall thirty-three feet to tide water, and allowing one-third of this on an average as available for power, 1,200,000 cubic yards per hour will provide 7,000 horse-power for the whole twenty-four hours throughout the year, reckoning by the standard of 33,000 lbs. through one foot for a horse-power. But as good steam engines now usually *exert* a force of 60,000 lbs. for every nominal horse-power, the above quantity of water

and extent of fall will give only 4,000 horse-power, assuming, as the standard of measurement, the present usual nominal horse-power of steam engines.

This amount of power, being available for the whole twenty-four hours, would be equal to the daily work of 42,000 pairs of bullocks, allowing their effective work to be 16,000 lbs. per minute, and time of labour eight hours per day; and the value of this, at five annas ($7\frac{1}{2}d.$) a day per pair of bullocks, would be Rs. 13,000 (£1,300) a day, or more than forty lacks (£400,000) a year, besides rendering unnecessary the provision of a Capital of twelve lacks (£120,000) for the purchase of bullocks.

If the comparison be made with steam-power, we shall find that it would cost about twenty lacks (£200,000) to establish engines of the united powers of 4,000 horses; they must be worked night and day, and the cost of working them in that locality would be about eight lacks (£80,000) a year, allowing wood fuel in the Delta at one rupee (2*s.*) a ton, and including wear and tear, interest, &c. Thus the cost of steam-power, calculating upon large engines, would not exceed one-fifth of the cost of bullock labour. This is the value of the water-power throughout the year; but only a third of it will be the effect of the 3,000 millions of cubic yards supposed to be stored in tanks for the purpose of improving the navigation, and therefore only the sum of two and a half lacks (£25,000) a year should be credited on this account.

But it is evident that here also the money difference is far from correctly measuring the value of this water-power, inasmuch as it would be much more convenient than steam, both by rendering unnecessary the erection of steam engines at a cost of twenty lacks (£200,000), and also by the great superiority of water over steam-power, in its certainty, manageableness and safety.

The water stored in tanks would thus be of value in four different ways:—

1st. In lowering the river in floods, and thereby diminishing the risk to the crops and other property in the district; which, however, cannot be measured in money.

2nd. In improving navigation, which has been calculated at one rupee (2*s.*) per 200 cubic yards, or 150 lacks (£1,500,000) for 3,000 millions of cubic yards.

3rd. For irrigation during the dry months, which, calculated (as above) at one rupee (2*s.*) per 300 cubic yards, gives a total of 100 lacks (one million sterling) for the 3,000 millions of cubic yards.

4th. For water-power in the Delta, calculated (as above) at two and a half lacks (£25,000) a year, when compared with steam-power.

Thus we have more than 250 lacks (two and a half millions sterling) as the total annual *value* of 3,000 millions of cubic yards of water when

fully employed, while the *cost* of storing that quantity, at 28,000 cubic yards per rupee (2*s.*), would be only Rs. 1,10,000 (£11,000) a year, or a little more than one lack (£10,000).

Now let us stop a moment to consider what we may, I think it will be allowed, fairly expect to be the effect in the basin of the Godavery of thus turning to account this invaluable treasure, water.

We have at present a vast extent of country on the Upper Godavery (about 120,000 square miles) occupied by perhaps 100 inhabitants to the square mile, who are almost entirely cut off from the products of the Coast and from foreign trade, by a cost of transit of fifty or sixty rupees (£5 or £6) a ton. They can grow most beautiful cotton cheaper than any country in the world, and have thus in their possession one of the very first desiderata of the wealthiest country in the world, England; but of this they at present sell only about 20,000 tons, worth forty lacks (£400,000), the produce of about 700 square miles, or $\frac{1}{170}$th part of the area of the basin; while England is ready to buy of them at least 250,000 tons, besides which, China could take an unknown quantity at such a price as they could afford to sell it for.

The people of this tract at present pay for rice about Rs. 120 (£12) a ton, while, with cheap transit, they could get it from the irrigated Delta for thirty rupees (£3), and they also pay Rs. 100 (£10) a ton for salt, which they could get by the river for thirty-five rupees (£3 10*s.*). Again, they can grow wheat at twenty rupees (£2) a ton, which, if conveyed to the Coast by the river, would be there made into flour by the water-power, and would then be worth about eighty rupees (£8) a ton, whilst the cost of transit and grinding, and loss in weight, would not exceed fifteen rupees (£1 10*s.*) a ton.

In the Delta of the Godavery there are about 600,000 people occupying an area of 3,000 square miles of the richest land, perfectly capable of bearing two millions of people. Before the new Hydraulic works were commenced, their foreign trade amounted to only three or four lacks (£30,000 or £40,000) per annum; there were scarcely any European inhabitants, and to pay a Revenue of nineteen lacks (£190,000) a year, there was an annual drain of specie from the district, that is to say, the Revenue was actually paid in part out of Capital. There were no internal communications whatever, excepting a very irregular one by the river, which was almost impracticable during high freshes and in the dry season, and which of course, from its distance, was of no use at all to by far the greater part of the Delta.

There is an excellent port at Coringa; but owing to there being only nine feet of water over the bar of the river, it can scarcely be made any use of for repairs; and thus the district is almost entirely shut out from European enterprize and Capital.

Now let the following sums be expended upon water works, *viz.* :—

Storing 3,000 million cubic yards of water, improvements in the bed in the river, &c.	20 lacks	(£200,000)
Hydraulic works in the Delta	25 „	(£250,000)
Deepening bars, &c.	5 „	(£ 50,000)
Total . .	50 lacks	(£500,000)

or half a million sterling.

The following may then be the changes that will take place :—

A trade in cotton, of at least 150,000 tons a year, will rapidly spring up, bringing in an income of 300 lacks (three millions sterling) to the Upper Godavery districts. An equal quantity of rice will probably be imported, causing a saving to the people of nearly 150 lacks (one and a half million sterling) a year; and even the present population would consume about 100,000 tons of salt, in which there would be a saving of sixty-five lacks (£650,000) a year. They would also sell perhaps 100,000 tons of wheat, producing an income of twenty lacks (£200,000) even at the present rate. With this vast export and import trade of four millions sterling in value of goods, there would of course be an extensive settlement of European merchants throughout that fine country, which, though excessively hot for three months in the year, has an exceedingly pleasant climate for the other nine. Thus the foundations would be laid for bringing European influence to bear fully upon the Native population, and an immense demand for every kind of English manufactures would inevitably spring up, for as soon as the people become sellers, they must needs become buyers also. Would not this connection with Europeans lead, through God's providence, to the improvement of the people in every respect?

Again, were the people in the Delta provided with an unlimited supply of water for irrigation, and with 1,000 miles of water communication within the Delta, having thus the means of growing sugar, rice, chillies, &c., at prices which must give them the command of almost all markets with an immense demand from the upper parts of the basin, for all their peculiar products, salt, &c., with a safe port affording advantages for repairs of shipping beyond almost any port in the world, on account of the cheapness of labour, &c.; a people so situated must necessarily soon become a wealthy community, and increase so as fully to occupy the whole Delta. A vast mercantile city, with a trade of two or three millions sterling, would be formed on the Bay of Coringa; extensive establishments for building and repairing ships would follow, and numerous sugar manufactories, and water-power mills for grinding, and various purposes, would also be erected.

Have we not fair ground for believing that all this prodigious change would take place, solely by turning to account 3,000 million cubic yards

of water (less than a single day's discharge of the river) that now flows uselessly into the sea?

I may also mention two facts bearing upon the case. One is, that within a few months of the time that the water was turned into one of the talooks of the Delta, where sugar was an article of produce, the cultivation was increased *four-fold*, though only a small extent of canal was cut. The other is a statement of the requirements in the way of transit, of one of the sugar works in the Delta, which, while manufacturing 2,000 tons of sugar per year, requires to convey the following quantity of goods annually :—

	Tons.
3,000 tons of jaggery, thirty-five miles	105,000 for 1 mile.
2,000 ,, ,, sugar, ,, ,, ...	70,000 ,, ,, ,,
10,000 ,, ,, firewood, ,, ,, ...	350,000 ,, ,, ,,
Total ..	525,000 for 1 mile.

This is now all carried by water; but to convey it by land (when the country is dry enough for it to be moved at all) would cost two annas (3*d.*) a mile more by land than by water; or Rs. 66,000 (£6,600) for the whole distance, equivalent to a charge of £3 a ton on the sugar, and sufficient to make the difference of the works being highly profitable, or to cause a total loss of the Capital sunk.

If this fact be not sufficient of itself to prove what India loses from want of cheap transit, what could prove it? These works are not situated 500 or 1,000 miles in the interior, but in one of the Coast districts, and only thirty-five miles from the port, and yet the want of water carriage would alone be sufficient to turn the scale, whether Capital invested in this way would bring in a large profit, or whether the whole would be lost. This difference in the cost of carriage would be 13 per cent. upon a Capital of £50,000, which may have been the sum invested. And of course this sum of money saved, does not fully measure the value of the water carriage which is always available, because before, when the Delta was under cultivation, and flooded in all directions by the monsoon, goods could not be carried at all by land, on account of there being no practicable road. In a neighbouring district there are works capable of making 10,000 tons of sugar a year, situated about forty miles from the Coast, and some of the jaggery is carried thither from a very great distance; water carriage for those works would probably make a difference of more than £10,000 a year. Even if that district were fully provided with railways, there would still be a loss to the owners of these works of more than £3,000 a year, as compared with water carriage, even supposing the railways worked at the lowest rates proposed by their advocates, *viz.*, eight pice (1*d.*) per ton.

I may here also call attention to the small importance of cheap water-power for manufactures, &c., as compared with the application of the

same water to cheapening transit and produce. The same quantity of water, which, by the above calculations, would be the means of saving 250 lacks (two and a half millions sterling) a year, when applied to navigation and irrigation, would only save eight lacks (£80,000) a year, by substituting water-power for steam, to the extent of 4,000 horse-power for the whole twenty-four hours; or forty lacks (£400,000) if substituted for the same amount of bullock-power. At these rates the Godavery navigation would be equal in value to 76,000 steam horse-power, working the whole twenty-four hours. And the use of 9,000 million cubic yards in the Delta for irrigation would, at the rate of 300 cubic yards per rupee (2*s.*), be equal in value to 150,000 steam horse-power. We give this calculation in order to show the immense comparative importance of cheap transit and produce to a country above steam-power for manufacturing, &c., even if it could be had for nothing.

It would seem almost impossible for any person to examine the circumstances of this basin of the Godavery, without being convinced, that no known mine in the world could compare with the value of this water mine. We may safely reckon that fifty lacks (half a million sterling) spent on it, will, within a few years, produce property to the value of 250 lacks (two and a half millions sterling) a year, the interest of sixty millions sterling, or one hundred and twenty times the amount expended; while the gold mines of Port Phillip only produce four times the amount expended in working them; and this, too, without the tremendous evils connected with gold digging.

In this enquiry I have not touched upon the subject of iron and coal. We know that iron ore of the first quality, and in the utmost abundance, is found in the line of the Weingunga, and that it is now worked to a great extent by the Natives in their miserably defective way. We know that coal exists in three localities, though we have no satisfactory evidence as to its quality or accessibility in those sites; and last year a large mass of very good coal was brought down to Rajahmundry, but we have not been able to ascertain where it was found. We know, however, that coal in abundance is found at no great distance from the site of the iron ore, that is, near the Nerbudda: a quantity of this was quarried by Captain Fenwick, and conveyed to Bombay, and there, I am informed, pronounced to be of very good quality, and all particulars respecting it are no doubt to be found recorded at Bombay.

We have thus every reason to believe, that in addition to all the other sources of wealth in the basin of the Godavery, it will become the seat of an immense coal and iron manufacture, one of the grand desiderata for India.

It may be here noticed, that when once a weir is constructed across any river, the whole upper part of the basin of that river becomes available for storing water; and an immense extent of country being open for the selection of sites for reservoirs to retain water for irrigation,

it is no longer necessary to construct an irrigation tank on every spot where cultivation is to be carried on. Wherever a site can be found, which will afford great capacity with a short bund, water may be stored, and allowed to flow down the natural water-courses and the river, to the weir, from which it will be led by channels to the cultivable land. Many of the large rivers of the Peninsula are so circumstanced; for instance, the Tambrapoorney, the Vigay, the Cauvery with its branches, (the Ambravutty, the Noel, and the Bowany), the Vellaur, the Cheyar, the Toombudra, and the Godavery; and weirs are now building on the Kistnah and the Pennaur, and estimated for on the Pallaur. This opens an unbounded field for improvement, and were there but one-fifth part of the number of Engineers that are required in the Presidency, the country ought immediately to be examined with a view to such sites for tanks. In connection with this subject, and as a specimen of the difficulties that Engineers had to contend with in times past, in trying to get the Government to take advantage of the magnificent capabilities of the country, it may be mentioned here, that at one time the construction of such tanks on the Neilgherries, where there are remarkably fine basins available, was pressed upon the authorities; and besides many almost equally ludicrous objections to the project, officially put forward, the question was triumphantly asked, "How could it be known where the water from such tanks would flow to?" the objector being perfectly satisfied in his own mind, that it was beyond the capacity of man to ascertain whether a certain stream flowed towards the East or the West Coast. Upon exactly such grounds as this, have innumerable plans for improving the country been rejected, by those who were fully satisfied that they were the ablest men of their day, and who looked down with extreme contempt on the poor creatures who put forward such senseless schemes as these. In this respect almost the whole Peninsula is ready for the construction of magnificent reservoirs on all its great rivers, the water of which would be at once applied to the land by means of the rivers and channels already existing in the plain country, which channels are at present but imperfectly supplied with water even during the rainy season, and are either very partially, or not at all, supplied during the dry season.

As another example, a sketch may here be given of what may yet be done by means of water, even for the best irrigated district in India, *Tanjore*, already so often referred to. This district contains seven or eight thousand acres of irrigated land, which are pretty well supplied with water for six months in the year, though not without occasional deficiencies; but for three or four months scarcely any water flows through it.

Some use is made of the Cauvery and Coleroon and their branches in this Delta for navigation; but this is precarious even during the rainy season, and quite stopped during the dry months. At least one million

cubic yards of water per hour could be profitably employed in this district for six months of the year, in addition to its present supply; besides a considerable quantity in reserve, to supply occasional deficiencies during the rains.

Thus 5,000 millions of cubic yards of water could, with immense advantage, be stored up, even for this already highly irrigated district; and this would not only allow of the cultivation of sugar to any extent, (which is at present almost impracticable from the supply of water not continuing long enough for a ten or eleven months' crop), and thus give the district its grand desideratum, a new article of foreign commerce; but would also furnish several lines of river navigation running through the very heart of the district to the Coast. The rivers within the limits of the district have a fall diminishing from three feet to one foot per mile, and though not affording anything like such a navigation as would be obtained by means of a steam-canal, would still at once be the means of effectually relieving the district from its present intolerable burthen of land transit, two and a half annas ($3\frac{3}{4}d.$) per ton. As a specimen of what this burthen is on one item of trade which exists, notwithstanding such a hinderance, we may mention, that about 60,000 tons of rice annually exported to Ceylon are carried on an average thirty miles, at a cost of nearly three lacks (£30,000) a year; whereas five-sixths of this might certainly be saved, if the rivers were made permanently navigable.

Now a stream of one million cubic yards an hour would not only be the means of rendering navigable the branches of the river within the Delta, but would also enable the navigation to be extended inland to near Bowany in Coimbatore, about 180 miles from the sea, from which point it is now navigated at intervals during the freshes by means of basket boats; and thus, with the new stream within the Delta, at least 500 miles of river navigation would be provided through one of the most densely populated tracts in the world. A line of canal (about fifty miles in length) has already been formed, running in the direction of Madras from the heart of the district, and connected with the Cauvery; and the extension of this along the Coast for twenty miles, has now been ordered. About 100 miles of exceedingly easy country along the line of backwaters to Madras would connect all this system of river navigation with Madras, and thus unite the place of greatest consumption in this Presidency with the richest producing tract.

To store 5,000 millions of cubic yards for this purpose would cost about thirty lacks (£300,000), and perhaps one lack (£10,000) more might be spent with advantage in trifling improvements in the rivers. It would not of course be advisable to go to great expense in improving the rivers for navigation, because it would be better ultimately to make regular canals; but in providing this water for the improvement of irrigation, the great object of relieving the country from the main part of the burthen of cost of transit would be attained. Though I have

stated the cost of the whole supply of 5,000 million cubic yards of water at thirty-one lacks (£310,000), yet it must be remembered, that a very small part of this, about three lacks (£30,000), would suffice to keep the rivers steadily supplied to a good depth during the present cultivating season, or for about seven months of the year; thus securing the present crops from drought, and keeping the navigation constantly open for that period at least. So that about three lacks (£30,000) spent on the remaining line of the Coast canal to Madras, and five lacks (£50,000) on an increased supply of water, would, even if nothing further were done, make an immense difference to this important district in money receipts, and the effect of a rapid steam communication with the city of Madras would be matter of far greater importance.

This then is a sketch of what is still wanted in the way of water improvements, even in the only district in India at all tolerably supplied with that fundamental necessary.

An outlay of only five lacks (£50,000) would give, besides this vast addition of water for irrigation, 300 miles of inland navigation for seven months of the year, while New York has been content to pay thirty-one millions of dollars (700 lacks, or seven millions sterling) for 365 miles of canal, open during only the same period of the year. And if only 50,000 tons a year were carried over the 300 miles, it would be a saving to this part of the country of thirty-five lacks (£350,000) a year, as compared with land carriage; and the additional water for irrigation (1,000 million cubic yards) would be worth ten or fifteen lacks (£100,000 or £150,000) a year.

Salt Water.

While writing about water in India, however, it ought not to be forgotten that fresh water is not her only treasure: the salt water is also of incalculable value.

Salt has been hitherto obtained at a very low cost, *viz.*, about two rupees (4*s.*) a ton, by the Native method, without the least hint from Europeans; but this Native mode of manufacturing is open to the same objections as their other operations, *viz.*, that of carrying it on upon too confined a scale, and without Capital. They think it impossible to manufacture salt excepting in the very lowest lands, on account of the expense of conveying and raising the sea water, and they consequently incur many far greater expenses, especially in respect to the liability to have the whole harvest destroyed by floods.

The following calculations will show in what enormous quantities salt may be manufactured, of the purest quality and at the most trifling cost. Sea water contains 3 per cent. of salt; or a cubic yard, weighing 1,700 lbs., yields 50 lbs.; and fully saturated brine contains 30 per cent., or 500 lbs. per cubic yard. A square mile of plain is equal to three million square yards, and consequently a square mile of area, one yard deep, will yield nearly 70,000 tons of salt; or we may allow 60,000. The evapora-

tion in the Carnatic during the months of March, April and May, is nearly half an inch a day on an average; and probably in extensive and very shallow reservoirs, it would be quite as much as that, so that we may safely reckon a yard of depth to be evaporated in less than three months. If therefore a convenient plain, one mile square, and from five to ten feet above the sea, were chosen and enclosed by a bank, one or two feet high, and if adjoining to that, a second area of about one-tenth the extent, or 550 yards square, were enclosed, the sea water might be raised to the first plain in such quantities as to keep it always near the point of saturation, and it might, as fast as it reached that point, flow off into the smaller area, where it would be allowed to evaporate entirely, so that when the amount of evaporation amounted to one yard in depth, there would be 500 lbs. of salt on every square yard of ground.

Care should be taken to obtain the water, in the first instance, as clear as possible; and while standing in the first reservoir it would deposit every remaining particle of *silt*, and flow off into the smaller one in a state of great purity.

The total quantity of water that must be raised in order to give this quantity of 60,000 tons of salt, would be three millions of cubic yards, or 5,000 millions of pounds; and as a one horse-power engine will raise at least three million pounds one foot high per hour, it would only require one horse-power for 1,700 hours, or 140 days, to raise the whole quantity one foot; or for 700 days to raise it five feet; or eight horse-power to do the same work in three months. The cost of working an eight horse-engine in such situations, would be about Rs. 400 (£40) a month, allowing 20 per cent. for interest and wear and tear, and charging the year's interest to the three months. This gives Rs. 1,200 (£120) for the cost of raising, to the height of five feet, water sufficient to yield 60,000 tons of salt, or, on an average, fifty tons for one rupee (2*s.*), or four pice ($\frac{1}{2}d.$) per ton. And if bullock-power be used, we may take it at 800 cubic yards raised five feet for one rupee (2*s.*), or Rs 4,000 (£400) for 60,000 tons of salt; equal to about one anna ($1\frac{1}{2}d.$) per ton, which shows that the cost of raising the water is an insignificant item.

Again, to lead the water to a convenient place, would be but a trifling expense. To cut a channel, one yard wide at the bottom and two yards deep, would cost about Rs. 300 (£30) a mile, so that even if it had to be cut several miles, and were only used for one year, the cost would still only amount to one or two pice ($\frac{1}{8}d.$ or $\frac{1}{4}d.$) per ton, on a manufacture of the extent of 60,000 tons. The expenses of collecting also, from a surface of something more than quarter mile square, would be equally trifling.

If the site chosen for the manufacture were a few feet above the level of tide water, it would not be liable to be submerged, and the only evil arising from untimely rains would be, that the reservoirs would receive two or three inches of water, which would take a few days to evaporate.

There are vast plains suitable for such works along the Coast. In Tanjore especially, near Point Calymere, there is a plain containing perhaps fifty square miles, in which salt could be manufactured on a magnificent scale, and probably at three or four annas ($4\frac{1}{2}d.$ or $6d.$) per ton. That tract has also the advantage of water from the Bay of Tondi, where, from its sheltered position, it is as clear as crystal; and the Coast there is also peculiarly favourable for shipping the salt, as there is smooth water, and consequently no surf. The Coast canal, when completed, will materially facilitate the manufacture, because almost any point on the whole extent of Coast may be taken, wherever the circumstances are most favourable, and whence the salt can be conveyed to any other point, at the rate of about one rupee (2*s.*) per ton, for a distance of 400 miles. The idea of Cheshire competing with India for this trade, is most absurd, unless some advantage, direct or indirect, be granted to the former.

There is only one important caution to be given on this subject, and that is, that fresh water must never be used. The salt manufacturers recently reported to the Collector of Masulipatam, that they had commenced their operations as usual; that the evaporation had proceeded just as in former years, but that not a particle of salt was produced; and, on careful investigation, it was found, that the creeks from which the salt manufacturers had been in the habit of obtaining their supplies of water, were in that year all filled with fresh water from the channels leading from the anicut in the Godavery, which was the only way in which this phenomenon could be accounted for.

This part of the paper may well be closed with a few lines on the water works in Rajpootana, as described in Colonel Dixon's work on Marwar. These consist chiefly of tanks, and though on a very small scale, and constructed in a very expensive manner, have yet produced such magnificent results, not only in rescuing the population from all the horrors of a state of disorganization, poverty and liability to famine, but even in direct and immediate returns in money to the State, that they furnish another clear and undeniable proof of the value of water. These tanks were chiefly formed by very massive walls of rubble in mortar, generally backed by earthen embankments. The largest of those in Marwarree, is stated to cover a third of a square mile, and to be about eight yards deep at the lowest point of the bed. The capacity is not given, but the mean depth would probably be thus above two and a half yards, and the contents two and a half millions of cubic yards. The total area of all the tanks constructed in Marwarree, is given at fifteen square miles, and, taking the mean depth of the whole at two yards, the total quantity of water stored in them would be ninety millions of cubic yards, and the cost, being stated at £24,000, would give 375 cubic yards per rupee (2*s.*) of Capital; or, taking interest at 4 per cent., the cost of water would be 9,400 cubic yards per rupee (2*s.*), which, allowing for the very small scale, and the very expensive mode of construction, agrees

well enough with the cost of water as already calculated in other parts of India.

The results of this expenditure also fully support all that is said of the value of water in India, as deduced from results in the Peninsula and in the North-West. The income to Government in Revenue had, in 1847, reached £11,000 a year, or forty-seven per cent.; and, taking the tax at one-third the produce, as stated, this would imply a further profit to the people of 94 per cent., making the total returns on the Capital amount to 141 per cent. There can be no doubt also, that with more experience in such works, the same quantity of water might have been stored at one-half, or perhaps one-third, of the actual cost; in which case the returns would have been 300 or 400 per cent., even with tanks on so very small a scale as these, the largest of which appears not to have been the twentieth part of the size of many of the old tanks in the Peninsula.

Again, in the adjoining district of Ajmere, 112 tanks, covering an area of twenty square miles, and containing perhaps 120 millions of cubic yards of water, cost £38,000, and yielded an additional Revenue of £10,000 in the fourth year from the commencement, showing the cost of the water to be thus about 8,000 cubic yards per rupee (2*s.*), allowing 4 per cent. for interest of Capital, and the returns in Revenue to Government being about 26 per cent., or probably 100 per cent. in all, as Capt. Smith estimates the benefit to the people, at nearly three times the amount of increase of Revenue to Government.*

It is of the utmost importance to observe, that these, as well as other isolated improvements by means of water, have been made solely in consequence of the earnest applications of the local officers, or the subordinate Boards; and this is the evident reason why there has been no general system of irrigation improvements carried on throughout the whole of India. Not only have these works not been suggested or ordered by the authorities at home, in the first instance; but even these wonderful results from every isolated case of improvement, have been totally insufficient to awaken the authorities to a sense of the importance of the subject.

* The scope and success of Colonel Dixon's measures have been sufficiently indicated in the preceding pages. Though much was done by his predecessor for the civilization of the Mairs, yet undoubtedly all this was most precarious, and their subsistence and employment were dependent upon most uncertain seasons; and the development of a great system of irrigation works (by which the falling rain is economized to the utmost and distributed in time and place of need, instead of sweeping down the valleys and passing away in a useless torrent), has been the means of giving permanence and advancement to the people.

By these works the country has been fortified against the miseries of famine; tracts of wild jungle have been converted into fertile fields, dotted with villages and alive with rural industry; population and Revenue have more than doubled; families which, for generations, had abandoned their native hills, have returned to seek their traditional landmarks; the inducement to constant migration and unsettled habits done away, and a taste acquired for the sweets of profitable toil. The wild unmastered Caterans of 1820 are thus found to have become, in 1843, a thrifty, thriving, peaceful, and industrious peasantry, an example to their neighbours, whose terror they once were.—*Captain B. Smith, p.* 425.

Who would not suppose that such cases as these, of Marwarree and Ajmere, would at least lead to the question being asked, " May not these magnificent results, calculated to benefit the people so immeasurably, and at once to relieve us from our intolerable load of anxiety about the finances, be obtained by like means throughout India?" What has as yet been done in this way, has always been done at the personal risk of the individual, who has had no better knowledge of his own interests, than to insist upon this extravagant expenditure; and no one has yet been found bold enough to propose, that, in addition to a Board of Revenue, (Collectors), a Military Board, and a Judicial Board, there should be a Board of Irrigation and Navigation to facilitate the provision of the Revenue collected, and by which themselves and all the rest were to be paid. And yet until the matter is seen so far in its true light, as to lead to the appointment of such a Board, India will never flourish.

Sketch of Water Transit System for India.

It may be well here to say something specific about a system of water transit for India, though the data for such a project are at present very insufficient.

It would not suit this paper to go systematically into the principles on which lines of communications should be selected; but we may just refer to the one fundamental principle, which must ever be kept in view, *viz.*, that each river basin will, in general, be the natural field of a system of communications complete in itself, the basis of the system being a main line leading generally along the line of the river, from near its source to the port at its mouth; because the densest part of the population is generally along that line, and there being great interchange of commodities produced in Coast districts or imported from foreign countries, and those produced in the higher lands and either consumed by inhabitants near the Coast, or exported. In providing communications for a vast extent of country like India, which is as yet entirely without them, we have the immeasurable advantage of a clear field on which we may bring to bear the great principles of science, with less interruption than in countries of smaller extent, where the natural course of things has already been interfered with by partial and isolated works, forming no necessary part of a well-digested system.

A map of India, coloured according to the river basins, and marked by contour lines, is one of the first things to be provided before planning communications generally for this country; for with this before us, we shall always be reminded when we are inclined to work against nature.

We may point out with respect to the main features in the present case :—

1st. That the river Ganges, with its branches the Gogra, Jumna, Chumbul, &c., the Burmpootra and other rivers in Bengal and the North-

West, as also the Mahanuddy, the Godavery with its branches, the Wurda, Weingunga, Indrawuttee, &c., the Kistnah (with its branches, the Beema, &c., from near the western ghauts as low down as Kurnool), and the Cauvery, have all such moderate falls (from half to two feet per mile) that they are already navigable for a part of the year, and could be made navigable throughout the whole year, at a comparatively moderate expense. To these perhaps may be added the Taptee and Nerbudda; but of these the falls are greater, and they would therefore require a greater expenditure. At any rate, however, at least 5,000, and perhaps 6,000 or 7,000 miles of navigation, could thus be obtained, and at the same cost as 100 or 200 miles of high speed railway. The Kistnah, below Kurnool, has a greater fall, and might require considerable works; or else we might substitute a canal, or low speed railway, for 140 miles.

2nd. That there is a vast extent of country in India so favourable to the construction of such works, that many thousand miles of first class steam-canals might be constructed at the rate of Rs. 6,000 (£600) a mile, and under.

3rd. That Rs. 15,000 (£1,500) a mile for canals would be sufficient to provide for their being carried almost entirely throughout the populous parts of the country.

4th. That the various systems of navigation in the basins of the different rivers, where the water sheds are too high to allow of the construction of canals without excessive expense, might be connected with each other by means of low speed railways, so as to provide for very cheap conveyance of goods from every part of India to the other. Thus, goods might be conveyed by one kind of navigation from Cape Comorin to Nagpore, and then by a cheap railway across the basin of the Nerbudda to meet the system of navigation of Central India, the North-West and Punjab; so that by means of two continuous lines of water communication, 1,400 and 800 miles long respectively, connected by 300 miles of railway, goods could be cheaply conveyed for a distance of 2,500 miles; and, allowing half a pie ($\frac{1}{16}d.$) per ton per mile for the water transit, and two pice ($\frac{1}{4}d.$) for the land transit, the cost would be only nine rupees (18*s.*) per ton for the whole distance; not more than equal to the present cost of conveying a ton of goods fifty miles, in most parts of the country.

It must be particularly pointed out, however, that the connection of the different systems of navigation with each other, is a matter of comparatively very small importance; the transfer of goods from one river basin to another being an insignificant matter, compared with the collection of the produce of each basin and its conveyance to the Coast, and the carriage of produce from the Coast and its distribution through the basin. Thus the communication across the water sheds will always have a very small traffic compared with that on the communications leading from the upper parts of basins to the Coast; and this brings us to another point, which

seems to have been wonderfully misapprehended in the great question of communication. We hear continually of a railway from Bombay to Calcutta, or Agra, or Madras, though in point of fact, the connection of these places with each other are matters of so small importance, that it ought not at present to be thought of. How many tons of goods, and even how many passengers, would pass from one of those places to the other, as compared with the number passing from the interior of the country to each Presidency? I think we are safe in saying, not one ton of goods to a hundred, and not one passenger to fifty? No doubt, one thing that has led very much to this misapprehension, is the political and military point of view in which this, as well as all other Indian questions, have hitherto been viewed: and it is certainly a matter of importance, that we should have the means of moving troops rapidly from one part of India to another, but still there are other considerations of moment:—

1st. This even is chiefly a question of economy, that is, the object in view is to economize, by rendering a smaller force sufficient for defence, and if while making a certain line of railway, to save a lack of rupees a year in expenditure on soldiers, we are neglecting another line, by means of which we could obtain an increase of income of ten lacks by extended sale of produce, this is of course false economy. It is just the old mistake which has pervaded our whole Indian system, of thinking a hundred times as much about one lack (£10,000) of expenditure, as of 100 lacks (£1,000,000) of income; for the idea always seems to have been, that if we can only retard the money in oozing out, it will come in of itself without our help.

2nd. Even as respects military purposes, the transfer of troops from one capital to another is comparatively of little importance; the point to be kept continually in view while we have an unimproved country of one and a quarter million of square miles before us, is not, "Is such a work wanted? won't it be very beneficial? or will it pay?" but rather, "Is it the most important work we can have for our time and money?" Nor is the question "Will it diminish our yearly expenses?" but rather, "Will it either diminish our expenses, or increase our income, *more than anything else?*" This is the first question with beggars such as we are; and when we have taken off the rough edge of our difficulties, by seizing every opening for obtaining great returns at a small cost, (with which a totally unimproved country must necessarily abound), then we may take in hand secondary projects.

North and South lines in the Peninsula, and lines about the water sheds in the interior, will generally be quite out of the question at present, at least for railways; but it must not be forgotten that what may be very bad policy in a line of railway, may still be good for a canal for two reasons:—

First, because of the difference in the cost of construction and of working; for goods may be carried 100 or 200 miles round by water,

without much disadvantage, because the cost of transit is extremely small, whereas on a railway it will be a much more serious item. It is not at all likely that any very large quantity of goods would bear transferring from one Coast of the Peninsula to the other by railway, but this is quite supposable by canal.

The second reason is the great value of water for irrigation and other purposes. A canal, twenty-five yards broad and three deep, will, with a fall of one inch a mile, have a current of 1,200 yards an hour, and convey 90,000 cubic yards per hour, sufficient for 30,000 to 90,000 acres of rice; and in a great proportion of cases, it will be most profitable to use the water for both navigation and irrigation, as is now done in the Godavery and Kistnah works. In planning communications for India, it must never be forgotten, that *every puddle is a valuable thing in a tropical climate in the dry season*, and thus every mile of canal throughout the country is entirely independent of the advantages of navigation, an incalculable blessing. It is true that this is one of the things, that a man who has never been out of England cannot fully realize; but if every man who takes a part in Indian affairs, were only to take a few walks in the middle of the day, with a land wind blowing, and the thermometer at 110°, he would have a very strong impression of the advantages of canals and tanks. Unfortunately, however, even some Englishmen, who have passed twenty or thirty years in India, have never taken this sort of practical lesson in Hydraulics; whilst the Natives who have, wonder that their rulers show so little interest about Hydraulic works, and even leave so many of the old ones in ruins.

As regards railways, even supposing 1,000 miles to be laid, it should not be in one continuous line, the centre part of which would certainly have very little traffic; but should rather be laid in short lines of 100 or 200 miles, leading direct from ports to the interior, or from the interior to a canal. Thus, in the projected railway from Madras to the Western Coast near Cochin, the centre 200 miles running nearly north and south and along the trade-shed of the country, will not have a twentieth part of the traffic on it, that it would have if laid on some line or lines leading from the Coast into the interior. Even if the Government care nothing about these points, what will the shareholders say to the returns on their whole Capital being reduced in consequence of these barren portions of the line, to a quarter of what they might otherwise be? Our first object is then to select those lines on which there is, or would be, the greatest traffic, rather than to aim at long lines, a great part of which would be comparatively unimportant; and to that end, let every line be brought distinctly to this test, *viz.*, the probable amount of traffic on it. There can be no use in connecting two great places, if comparatively few goods or persons pass from one to the other. The main question is, *not* whether a certain line would be useful? but whether it be in proportion to its cost the *most* useful one we could undertake?

It is also to be observed, that the natural lines are often not the shortest; there are certain natural obstacles which cannot be altogether got rid of, though means may be found greatly to diminish the expense of passing through, or over them; and though the force of gravity cannot be removed, the inconveniences caused by it may no doubt be greatly mitigated.

With so vast an extent of country under one paramount authority, and with the experience we now have from different countries, in irrigation, river and canal navigation, railways of different classes, and in harbour works, we ought to be able to plan such a system of communications and other works for India, as has never yet been seen in the world; and thus certainly make a near approach to that grand desideratum, *the annihilation of cost of transit.* If canals be used for irrigation, as well as navigation, there can be no doubt that they will abundantly pay the interest of the money expended on their construction and repairs, thus leaving, as the cost of transit on them, only the bare expense of draft. By actual calculation from the data we have, it appears, that on canals, six feet deep and provided with locks 150 feet by fifteen, and with the low cost of fuel generally throughout India, (half a rupee a ton of wood), the actual cost of transit on long lines worked by steam would be, if the vessels have constant employment, about quarter pie per ton per mile, or one rupee per 800 miles, including interest on boats and engines at 10 per cent., wear and tear, &c. It appears from calculation, that the rate which will give a minimum cost of freight with steam-power, in vessels of the size for the above locks, is about five miles an hour through still-water, and that a rate of six miles an hour would add very little to the cost; so that allowing for delays at locks, the most economical speed for goods, where the trade is extensive, would be upwards of 100 miles a day, (the canals being worked by night as well as day); and there is only a very small proportion of goods, for which it would be worth while to pay a higher rate for conveyance 500 miles in one day, than the same distance in five days. This is partly proved by canals in England, which, on the principal lines, carry as much as nine-tenth of the goods, notwithstanding the higher speed of railways; and although, owing to the canals and locks not having been made for steam-power, the rate of transit is only about two miles an hour.

As some, however, may still object to the use of steam-canals, on the ground that it has been tried in England and has not succeeded, it may be well to answer this objection here:—

1st. Steam cannot be used on the old canals, for the simple reason that they were not made for it.

2nd. The Canada canals are navigated by 300 ton steamers, at the rate of six or seven miles an hour for goods.

3rd. The grand difficulty in England, *viz.*, injury to the banks from the ripple, would be easily removed here, as it would not cost more than

£200 a mile to line them throughout with stone. And though canals not made for steam cannot be worked by means of it, this is no reason why canals should not be made suitably for this power. The objection that locks cause so much detention, is equally untenable: it is true that locks made so as to take five minutes to fill and empty, do cause much detention; but there is no reason at all why a lock should not be filled in a few seconds, and the detention thus reduced to little more than the mere stopping and starting the boat. Where the traffic is very great, as it would be on some lines in India, separate locks should be made for the swift traffic, with all the necessary arrangements for a quick passage through them, without the smallest hinderance from the slow traffic. Such a canal would accommodate an almost unlimited extent of traffic, and if we reduce the cost of transit to half a pie per ton per mile, we must be prepared for a traffic beyond anything we have any idea of at present. It is in this respect especially that the necessity for canals will be seen. A traffic of five million tons a year, or 17,000 tons a day, on a canal fitted for boats of 170 tons, would only require a boat to pass the locks once in a quarter of an hour, and by the addition of a second lock, any amount of traffic might be provided for, and the repairs of the canal would not increase in proportion to the traffic. Now, to accommodate such a traffic by railway, would require perhaps five lines of rails; but they would not indeed really be required, because railways never could be worked at so low a rate of toll, as to lead to so free a traffic. Some of the railways in England seem to have nearly reached the maximum of traffic (to judge from the accidents) though carrying only 200,000 tons a year; while some of the petty canals there, worked only by horses and furnished only with single locks, carry a million tons a year and upwards, and are probably capable of carrying much more. All plans for improved communications in India, that do not keep in view this main point, *viz.*, the vast extent of traffic that will arise in consequence of the cost of transit being reduced, as it ought to be, will be found equally inefficient; and there is not the slightest prospect of the high speed railways providing for any enormous traffic.

Erroneous Ideas regarding Irrigation.

It seems of importance yet to speak on some further points connected with the use of water in India, and though it is of course impossible to meet beforehand all the erroneous ideas of persons quite unacquainted with the subject, which, being the fruits of the imagination, are innumerable; yet, amongst the many strange fancies prevalent in regard to irrigation, some of the most popular may be usefully remarked upon.

One is, that well irrigation should be encouraged, and even that the Government should dig wells for that purpose. It is, however, surely a sufficient answer on this point, to refer to the calculations given in the preceding pages, which show that the mere raising of filtered water from wells twelve to fifteen feet, without including the expense incurred on

account of the well, costs about one rupee for 500 or 600 cubic yards; while water of much superior quality may be applied to the land by means of tanks and river channels, at a cost of one rupee for from 20,000 to 40,000 cubic yards, or from one-fortieth to one-eightieth the cost of merely raising it from wells. Instead therefore of encouraging the people to construct private wells, at such an enormous waste of money, Government should do their utmost to render such waste impracticable, by providing water everywhere, and selling it at one-twentieth the cost at which it can be obtained from wells.

Another fancy is, that tanks should be *cleared out*, that is, that their beds should be excavated from time to time. Now it is evident, that for every cubic yard of earth thus excavated, one cubic yard of water per annum will be obtained; so that if 1*d*. per cubic yard be paid for excavation, and the interest of money be 4 per cent., we shall have to pay $\frac{1}{24}d$. per annum for every cubic yard of water, or one rupee for 576 cubic yards; while it would cost only one-fiftieth of that sum to obtain the same quantity of water by raising the old bund, or making a new tank. "Then do you mean to say that tanks are never to be *cleared out?*" Certainly not; that can never be done with advantage or economy, as it costs fifty times as much as the work is worth; but as tanks become filled up, their bunds must be raised if they are to contain the same quantity of water. It seems not to be generally known, that, excepting in tanks supplied by very small streams near their sources, the process of silting up is very slow; but be it slow or quick however, it should not be remedied by excavation, on account of the disproportionate cost.

Another of these apprehensions is, that it is a waste of money to expend it on magnificent works like those of the Godavery, and that money might be much more economically laid out on a multitude of small works. On the contrary, however, it may be laid down as a general rule with respect to irrigation works, (as indeed with most things), that the larger the scale on which they are executed, the greater will be the proportional results. Further, a Delta offers peculiar facilities for irrigation, as it stands to reason that water can be distributed over a plain without undulations and with only a moderate slope in one direction of a foot a mile, far more cheaply than over a more uneven country; and no tract in India could probably be found, where water can be distributed at so small a cost, as in the Deltas of the Godavery and Kistnah, excepting indeed the Delta of the Ganges. Again, the Delta lands are generally the richest, and therefore will pay best for the supply of a given quantity of water; there is also the largest population in a given space, and consequently the water communications will provide for a greater traffic; and lastly, the larger the river, the greater the extent of country it drains, and consequently the more certain is the supply of water.

Another popular idea is, that tanks are uncertain works for irrigation, and that river channels alone can be fully depended on. This is true in a certain sense; that is, small tanks filled by streams which only drain a small extent of country are uncertain, and fail whenever there is a great failure of the local rains; and this is the case with $\frac{99}{100}$ of the old tanks of the country. But, in the first place, almost all these could be supplied at a moderate expense from the large rivers; and that this has not been done throughout the country, is one of the most grievous neglects of the British rule; and, in the second place, not only ought all tanks to be supplied from large rivers, but the tanks ought to be almost universally of great capacity. The Natives, from their peculiar circumstances, were generally compelled to make a multitude of these petty works; but this is no excuse for us, who have ample means and power to construct them on any scale. The sources of the great rivers of the Peninsula, which never fail entirely, are all within the British dominions; and there need therefore be no want of water, as large tanks, if connected with the great rivers, would always contain water all the year round. Many of the old tanks are noble works, both in respect of size and supply, some capable of containing 100 million cubic yards of water, and having very expensive channels led from the great rivers; but even they are not sufficient, and what we should now do, is to construct tanks of far larger dimensions than any now existing, in the same way as we have formed systems of channel irrigation on a scale far beyond the old Native works. The only novelty that I know of, to be introduced in the construction and use of these large tanks, is this: instead of irrigating lands immediately below their bunds, (as is universally done in the old tanks), rather to discharge water into rivers when they are low, for the supply of any system of channel irrigation connected with them. Every part of the country should be thus furnished with vast tanks, to be filled in the heavy bursts of the monsoon, and the water gradually discharged into the rivers according as they become too low, so as to keep up the supply of water for the irrigated land. Such tanks should contain from 1,000 to 5,000 million cubic yards; that is, tanks fifty yards deep and from sixteen to eighty square miles in area, or from two miles broad by eight long, to five miles broad by sixteen long, would store water at a cost perhaps almost as low as that of the Delta irrigation, and would never fail. It is too late now to use the old argument against these works, that nobody ever heard of such things, after the execution of the Ganges canals 850 miles long, and the Godavery weir two and a half miles long. It is only proposed to do that with respect to tanks, which has already been done with respect to river channels; and with our Western knowledge and unbounded means, we should not think ourselves bound to *follow* the Natives, who had not a thousandth part of our advantages, and who, we may be quite sure from what they have done in times past, would not

have followed such an example as we have set, if they had had our advantages. I doubt whether India has ever, for a hundred years together, been destitute of men, who, if only possessed of our science and resources, would have been ashamed to leave the country in the state in which we now see it.

Another idea is, that to supply navigable still-water canals with water all the year round, would be next to impossible; but this too is without the slightest foundation, either of experience or calculation. The consumption of water in such a work would be from the following causes :—

1st. Evaporation.

2nd. Absorption.

3rd. Lockage.

The evaporation in the Peninsula is about two yards a year, after deducting the fall of rain; that is, the difference between the fall of rain and the evaporation is about two yards. A mile of canal, thirty yards broad, would therefore require 1,760 × 30 × 2 yards = 100,000 cubic yards per annum, which would require, at 1,000 cubic yards per rupee (2*s.*), a Capital of Rs. 100 (£10) a mile, so that if the canal cost Rs. 10,000 (£1,000) a mile, the providing for the evaporation would cause an additional first outlay of one per cent., or the annual cost of the water would be four rupees (8*s.*) a mile—4 per cent. on Rs. 100 (£10)—equivalent to a charge of $\frac{1}{10,000}$*d.* per ton per mile, on a million tons per annum. This is one of the principal supposed obstacles to the construction of navigable canals in India.

We have abundance of experience on this point of absorption from the innumerable tank bunds and channel banks now existing. The fact is, that if the slopes are sufficiently gentle for the silt to lodge, every Hydraulic work puddles itself immediately. I have seen a channel cut through the loosest sand, widened by cutting a trench by its side within a yard of the water's edge, and to the depth of five feet, without the least moisture being found in the excavation; so perfectly water-tight was the lining of silt that the channel had furnished itself with. The loss from this cause also would therefore be insignificant.

As regards lockage. A lock 150 feet by fifty, and with a fall of three yards, would require 2,500 cubic yards of water to pass a boat; and if the navigation were 100 miles in length in one slope, (a very moderate supposition), it would require 25 cubic yards per boat per mile; as it is evident that a lock-full would be expended in the whole line. If the boats were of 200 tons, this would be one-eighth of a cubic yard of water per ton per mile; which, supposing the water to cost (as elsewhere calculated) 20,000 cubic yards per rupee (2*s.*), would be equivalent to a charge of $\frac{1}{160,000}$ rupee, or $\frac{1}{7,000}$*d.* per ton of goods per mile. Or, the total quantity of water required for a million tons per annum, would be 125,000 cubic yards for 100 miles, or 1,250 cubic yards per mile per

annum, to store which would require a Capital of one and a quarter rupees (2*s.* 6*d.*).

Such are the most serious obstacles that have yet been discovered to the establishment of permanent navigable canals in India. The total charge of transit on account of the cost of water might be (according to the above calculations) $\frac{1}{3000}$*d.* per ton per mile, or one rupee (2*s.*) for a ton carried 70,000 miles; so that if it were ten times as much as I have calculated, it would still be of no perceptible importance.

More of these fancied difficulties might be mentioned; but the explanations given above will be sufficient to show those not conversant with the subject, that other difficulties which occur to them may be capable of an equally complete and satisfactory solution.

Navigation and Irrigation Board.

Returning to the question of the necessity of appointing a Board of Irrigation and Navigation, we must observe, that the plan now proposed, of placing an individual nominally at the head of the Department of Public Works, which in reality makes the Government Council itself the Board of Works, will, we fear, aggravate all the former evils. Such questions *must* be *discussed;* they *must* be examined by both Engineers and Civilians, and consequently if there be only one individual at the head of the department, the Governor in Council will discuss them; and as the Council have fifty other things to do, every one of which they will think of more importance than tanks and canals, the latter will still be considered as mere bye-works, and the business will fall usually into the hands of a Secretary, who will not be the ostensible and responsible person. Of the absurdity of making the Council a Board of Works, and thus giving it duties to do which are quite foreign to it, we have a convincing proof in the case of the rejection of a proposed work, under the idea that a lock would oblige all the boats to wait for the return of the tide, and would let all the water out of the canal when it was opened. Not being conversant in such matters, the Councillors did not know that a lock was a work to allow boats to pass and keep the water in.

Nothing will do but a Board consisting of two or three persons, besides an Engineer, *who shall have nothing else to attend to whatever* but irrigation and communications; and this Board should be charged with *all* works of this nature, and their whole thoughts, time and energies, should be concentrated upon this duty. Public Works never can be properly attended to till this is done, and it is impossible that the appointment of a single Engineer to such a charge should answer the purpose. Let the petty details connected with buildings, and especially all the minute pottering about military buildings, be kept out of the hands of this Board, in order that they may be able to give all their time and energies to the fundamental and all-important general duties connected with Public Works throughout the country. But in order to prevent the

confusion at present arising from there being in Madras no less than five different departments employed about these works, (besides the department of Military buildings), let them all be under the general control of this Board and subordinate to it; the executive and supervisory part, however, being confided to two distinct classes of officers, who have no part in the Board itself.

There are at present: 1st, The Board of Revenue, in charge of works of irrigation, and part of the communications. 2nd, The Department of Roads; certain great trunk roads being nominally under a single Superintendent, but in reality immediately under the Governor in Council as a Board of Trunk Roads, with the Superintendent of Roads really an executive officer under them. 3rd, The Railway Department also under the Governor in Council, with an officer as Consulting Engineer. 4th, The Electric Telegraph Department, on the same footing. 5th, The Paumbam Channel Works, under the Chief Engineer subordinate to the Governor in Council. The consequence of this confusion is, that while one department is cutting a canal, and another a railway, a third is very busy making a grand road parallel with each. Fancy a private household in which the groom was entrusted with a small part of the cooking, the house-maid with another small portion, a third being entrusted to the butler, and the remainder left to the cook herself, excepting that which the master of the house, in his wisdom, kept in his own hands. Let any one imagine to themselves the utter confusion which would prevail in such an establishment, and they may then form an idea of the state of things in India in connection with Public Works, where the Government is employed partly in trying to regulate a state of things essentially productive of nothing but disorder, and partly in doing itself some of the work belonging to the humblest subordinate executive officers.

The curse of the Indian system is the continual effort, on the part of the superior authorities, to do everything themselves, and to meddle with matters of detail, for which they have neither time nor experience; and this is felt sufficiently even where a Board has charge of a department. Not only is an individual not allowed to *do* anything, but not even to *speak;* he is courteously told that his remarks are quite uncalled-for, and if not then silenced, other more effectual means are taken to prevent his making known the results of his experience, local knowledge, &c.

Great objections have been made to Boards as being a machinery very slow in its operation; but matters *must* be discussed, and there need be no delay connected with a Board beyond what is really necessary from the nature of the subject under consideration, unless the Board be composed of inefficient men, or have executive duties in detail imposed on them, foreign to their proper functions. Undoubtedly a Board composed of *ex-officio* men, that is, of men having other duties to attend to, and who were not selected for the specific purpose on account of their qualifications, is an

utter abomination. The Members of the Board we propose, should be *selected* for the peculiar duties of the Irrigation and Public Works Department, and then if the arrangement does not work well, the remedy is in the hands of Government, and is very simple; it is only to turn the Members out, and put better men in their place. It is not to be supposed that a man is to be put into an office of such importance, and then to be considered immoveable. While he holds the office he should be treated as a gentleman, and a man of sense, honesty and capacity; but if he be found not to be so, then he should be at once replaced by one who is. The system of keeping a man through thick and thin in such a situation, and then gagging him and treating him at every step as a fool, and a man not fit to be trusted with five rupees (10*s.*), will never do for a Board of Public Works, such as is now required in India. The Board must be left, in a great measure, to manage things their own way, a large portion of the outlay being left entirely at their own disposal, and Government only requiring constant reports of proceedings and results; every source of delay being avoided as far as possible, and especially that the greatest of all sources of delay, *viz.*, superannuated Members.

When we consider the magnitude of the field, and the trifling sum yet spent as compared with the outlay required, we are surely warranted in asserting that Public Works have been almost entirely neglected throughout India. The work that ought to have been spread over the last hundred years must therefore, if we wish to redeem our character, be done in the next ten; and to accomplish this will call for the utmost energies of men in full possession of all their faculties. Hitherto, the only mistake of any consequence that has not been guarded against, is that of *doing nothing*. The Board of Public Works ought to have written on the paper-stand in front of each Member and Secretary, in large letters, "Do it, do it, do it." The motto hitherto has been, "*Do nothing, have nothing done, let nobody do anything. Bear any loss, let the people die of famine, let hundreds of lacks be lost in Revenue for want of water, or roads, rather than DO anything.*" It is not the loss of money that we mind, that is nothing; we can afford to lose millions every year for want of Hydraulic works, and therefore to spend a few lacks of rupees on such works would of course be nothing; but, nothing must be *done*. Before anything is *done*, a matter must be brought before the Collector,*

* This misnomer was pointed out more than thirty years ago, by Sir Thomas Munro. "He," said that great man, "who is called Collector, exercises the whole of the internal administration of the province. His designation is an unfortunate one, and ought to be changed, as it leads to the belief that the collection of the Revenue is his sole duty, and that he is a mere tax-gatherer; but the collection of the Revenue is a very subordinate part of his duty; it extends to every branch of the finance, and its influence is felt in the prosperity of the inhabitants. He watches the operation of the different existing taxes, points out such as are oppressive, that they may be lowered, or altogether abolished. In every country the amount and distribution of taxation are perhaps the most important concerns of public authority; there are no others on which, as on them, the universal comfort and prosperity of the people depend. In this country the management of taxation rests almost entirely with the Collector; for he is the only channel through which the Government can obtain any tolerable correct information on the subject, and it is chiefly from his opinions that their own must be formed."

who has charge of the welfare, and, in a great measure, the lives of a million of people, and of a Revenue of thirty or forty lacks (£300,000 or £400,000) a year; but is still not permitted to spend £100 without superior sanction. He hands it on therefore to the Board of Revenue; but they have no power to sanction an expenditure of £100. It then travels on from the Board of Revenue to the Local Council; but the hands of that Council are tied if the project involves an expenditure beyond £1,000, so it must be passed on to the Supreme Council, who, dead to the wants and interests of those extensive kingdoms called "Minor Presidencies," are glad enough to avoid the inconveniences and responsibilities of expenditure, by referring the project to the authorities at home; and on its arrival there, it has to undergo the ordeal of two more Boards, the consequence of which is, that nothing, or next to nothing, has been done, in comparison with what is needed.

Now it should be remembered, that even the youngest of the authorities mentioned above, have, owing to the effects of climate and advancing years, almost ceased to be men of action; and every step the matter is carried upwards, it gets more into the region of *counsel*, and more out of the reach of *action*, and has consequently less and less chance of being carried into execution. In the superior Boards and Councils, there is generally not a trace of that physical energy, which is essential to produce real healthy and vigorous action; and this habitual exclusion of men in the prime of life (we must except an occasional young Governor-General) is undoubtedly one of the principal, if not the principal, defect of a system which has led to the exhibition of the extraordinary phenomenon of the most inert, stationary, decrepid management of a country that was ever seen by the most advanced and energetic race that has yet appeared in the world.

Who would not suppose, from the excessive precautions regarding expenditure mentioned above, that at least fifty districts had been ruined by works of irrigation and communication, and that now the only fear was, that anything further should be *done?* Who would believe that without half a dozen miles of real turnpike road, with communications generally in much the same state as in England two centuries ago, with periodical famines and a stagnant Revenue, the stereotyped answer to any one who urges on improvement is, "He is too much in a hurry," "He is too sanguine," "We must go on by degrees;" and this, too, in the face of the fact, that money laid out upon Public Works in India, has almost, without exception, yielded money returns of 100, 200, 300 per cent., besides immeasurable other advantages to the community.

What should we think of the owner of a heavily mortgaged, but improvable estate in England, who, with means at his command of doubling his income, should be afraid of arriving at that result "too soon?" And yet the only difference between the private landlord in England and the public landlord in India is, that whilst the one may have an

interest in a single square mile, the interest of the other extends over a million of square miles. The more extensive the field is, surely the greater is the need for energy and enterprise. We have already all but lost one century, to the great damage of our finances and the great injury of the people; and shall we now lose another century, by continuing to crawl, or shall we not rather make a strenuous effort to redeem the time we have lost, by working double tides, until we have fully developed the resources of our magnificent estate? The millions that we are about to spend upon a few costly and high speed railways, would suffice to accomplish that far more important object, to the great profit of the shareholders, of the people of India, and of the public treasury.

Precautions enough have assuredly hitherto been taken against that dreaded thing, *action*; but no doubt such complication of means are necessary so completely to keep down that innate energy of Englishmen, which commonly breaks through all restraints; and it must be granted, that no such success of this kind was ever achieved before. To keep down 5,000 or 6,000 Englishmen so effectually in the midst of such demands for exertion, and with the prospect of such results before them—a large proportion of them, too, faithful and conscientious men, who cannot bear to see the impoverished state of the people—this is no slight task, and to have succeeded in it, no doubt deserves the highest applause. The success has, however, not been so complete as could have been wished, after all. This irrepressible energy *has* oozed out here and there, and produced the few good results we have seen; and, if I mistake not, these are sufficient, too, at length to rouse England to say: "This state of things is at end. India shall no longer be kept in this degraded state; effectual measures shall now be taken to ensure to her a participation in those blessings which we ourselves enjoy; and we will find men who will enter heart and soul upon this great work."

APPENDIX

No. I.

*Conclusions.**

UPON the whole, the main points connected with the question of communications for India seem to be the following :—

1st. That the great point of all to be kept in view, is, not to make the most perfect communication possible on some few hundred miles in the course of twenty or thirty years, leaving the remaining 100,000 miles untouched; but rather, to adopt a system of communications, by which the principal part of the cost of transit will be saved, to be executed throughout the whole country in the shortest possible time.

2nd. That in order to accomplish this, we must, for the present, be content with less perfect communications than high speed railways, because it is impossible that the country can be covered with such, even on a few main lines only, within a hundred years.

3rd. That cheap railways and good common roads will have the effect of greatly reducing the present cost of transit; the latter taking off about one-half, and the former probably much more, besides giving us a speed of 200 miles a day for first class travellers, and from fifty to 100 for goods.

4th. That a great extent of river navigation may be improved, and canals cut at a moderate expense, say from Rs. 1,000 (£100) to Rs. 3,000 (£300) a mile, so as to reduce the cost of transit on such lines by nine-tenths.

5th. That the proposed rate of $2\frac{3}{4}$*d.*, or nearly two annas, per ton per mile for conveyance on the Bombay railroad, is really absurd; and that, in order to give anything like effectual relief to India, we must reduce the cost of transit to one-tenth of that sum, *viz.*, two pice (about $\frac{1}{4}$*d.*) per ton, which (even without reckoning the difference in the value of money) will correspond with about $1\frac{1}{4}$*d.* per ton per mile in England, because an article must be carried at least five miles in India for one mile that it is carried in England.

6th. That the rate of $2\frac{3}{4}$*d.* per ton per mile, on a railroad that has cost Rs. 1,20,000 (£12,000) a mile, is actually three times the rate at which goods are now conveyed on the grand trunk road in Bengal; and

* These conclusions having appeared in the London edition, are inserted almost *verbatim* in the Indian edition, without having had the advantage of Colonel Cotton's revision, prior to embarkation for England.—*Note by the Publisher, Revised Indian Edition of March* 1854.

half as much again as on the western road at Madras, which is still in quite an imperfect state.

7th. That in general throughout India goods can be conveyed on good common roads at an average of about eight pice (1*d.*) per ton, exclusive of carriers' profit and interest, even as things are now managed; but that, under European management, they would be certainly carried for less.

8th. That with a traffic of 100,000 tons per annum, on a common road costing Rs. 5,000 (£500) per mile, the interest at 10 per cent. would be one pie ($\frac{1}{8}d.$), repairs also (one pie), and allowing the same (one pie) for carriers' profit, the total cost, including the above average of eight pice (1*d.*), would be eleven pice, or say $1\frac{1}{2}d.$; about half of what it is proposed to charge on the Bombay railroad.

9th. That on a cheap railroad worked by cattle, the cost of transit would certainly be less than a quarter of that on a common road; say about $\frac{1}{4}d.$ a ton, including everything.

10th. That on a steam-canal, the cost of transit would not exceed half a pie ($\frac{1}{16}d.$) per ton, and the interest and repairs would not exceed half a pie more; or, in all, one pie ($\frac{1}{8}d.$) per ton per mile.

11th. That on an improved river, with a constant depth of three feet, the cost of transit would not exceed two pice ($\frac{1}{4}d.$) per ton per mile, including everything.

12th. That the average cost of transit in England may be taken at $1\frac{1}{2}d.$ per ton per mile, equivalent to two pice ($\frac{1}{4}d.$) in India, allowing for the difference in the value of money.

13th. That for every mile goods have to travel in England, they must be carried at least five miles in India.

14th. That the average value of goods carried in India is much less than that of goods in England.

15th. Hence, that even if the cost of transit in India were reduced to two pice ($\frac{1}{4}d.$) per ton per mile, it would still, allowing for the difference in the value of money and in distance, be equivalent to five times the cost of transit in England; besides that cost being charged upon goods of inferior value, and therefore less able to bear it.

16th. That at present, the average cost of transit in India may be taken at two and a half annas ($3\frac{3}{4}d.$) per ton per mile, which, allowing six-fold for difference in value of money, and five-fold for increased distance, is equivalent to 9*s.* 6*d.* a ton a mile in England, or seventy times what it is there; and that paid on less valuable goods.

17th. That a ton of cotton, value £12, conveyed from Berar to Bombay, costs about £9 for transit, including interest, &c.; so that to convey it from the place of production to the place of shipment, adds 75 per cent. to its cost.

18th. That a ton of cloth, value, suppose £40, conveyed from Manchester to Liverpool, costs only 5*s.* in conveyance from the place of pro-

duction to that of shipment, equivalent to an *ad valorem* tax of only five-eighth per cent., or not more than $\frac{1}{120}$th part of the tax paid by cotton in India, thus showing (as compared with 75 per cent.) the comparative state of transit in the two countries, taking into account increased cost per mile, increased time and risk, increased distance, and inferior value of goods.

19th. That there can be no sort of question, as to what is the main cause of the poverty and inertness of India, when we consider what would be the state of England, if the cost of transit there were equivalent to an *ad valorem* duty on its goods one hundred and twenty times greater than it now is.

20th. That in England, about eight millions sterling, say one-seventh of the whole amount of taxes, is paid for transit of goods, whilst in India probably not less than fifteen millions sterling, or about half of the amount of taxes, is paid for the same item.

21st. That, allowing for the difference in the value of money, this sum (fifteen millions) is equivalent to ninety millions sterling in England, or eleven times the amount paid there for transit.

22nd. That allowing the actual money cost of transit in India to be 3¾*d.* per ton per mile, or two and a half times as much as in England, and the distances in India to be five times as great, twelve and a half tons are carried in England at the same cost as one ton in India. And consequently that the fifteen millions paid in India, indicates, for a population about six times as great, the transit of not more than one-fifth of the quantity of goods that the eight millions paid in England gives; or, the proportion of goods moved in India, is, allowing for the difference of population, only $\frac{1}{30}$th of that moved in England. And, undoubtedly, $\frac{29}{30}$th of the present traffic in England would be stopped, if attended with the same expense as in this country.

23rd. That improved river navigation, canals, and cheap railways could be formed to the extent of 20,000 miles, at an average cost of Rs. 3,500 (£350) a mile; or, in all, seven millions sterling, which would provide for perhaps two-thirds of the present transit (the other third being conveyed by the feeders to the main lines) and save four-fifths of the present cost of transit, or eight millions sterling per annum; but at these reduced rates, probably at least five times the quantity of goods now moved, would be carried.

24th. That a large proportion of this expenditure would be for iron, &c.; and as these canals and cheap railways might be begun at once in every district in India, they could be easily completed in five years.

25th. That 50,000 miles of cheap railway, with temporary timber bridges, at Rs. 3,000 (£300) a mile, could be made in the course of ten years at a cost of about fifteen millions sterling, which would cause a saving of about five millions sterling in transit, even on the present

amount of traffic, and cause the traffic to increase perhaps four-fold on all these lines.

26th. That if in this way the grand point of the establishment of cheap transit throughout the country within a few years were secured, the present Railway Companies may, if they please, go on with their snail's-gallop of twenty miles a year, as that will do little harm; but if they are allowed to seal up any important lines of country to the present enormous rates of transit, or anything like it, they will do most serious mischief.

27th. That with respect to passenger traffic, the great mass must be carried at about one pie ($\frac{1}{8}d.$) a mile, or little will be gained.

28th. That if carried at this rate or less, the numbers will be immense. At present, over a vast extent of road, there are from 1,000 to 3,000 travellers a day; and probably with an increased speed of from twenty to 100 miles a day, and a charge of only one pie ($\frac{1}{8}d.$) per mile, there would be a four-fold increase in the number.

29th. That the proportion of first class passengers, or those who can afford to pay much more for going at 700 miles a day than for going at 200, is utterly insignificant.

30th. That a speed of 200 miles a day for first class passengers and valuable goods, is abundantly sufficient for the present state of things in this country.

31st. That a very high speed is at present absolutely unattainable, and in this respect the great railroads are a complete delusion; for in ten years, perhaps 500 miles at the utmost may be opened, leaving the other 19,500 miles of main line to be traversed at three miles an hour.

32nd. That if we will be content with a moderate speed of 200 miles a day, we may have it all over India in five years; whereas, if we will not have this, we must, for centuries to come, go on at three miles an hour over the greater part of the country.

33rd. That the present plan for opening India by high speed railroad is like preparing a loaf by taking wheat grain by grain, and thus grinding, kneading, baking and eating it; so that with our food all the time before us, we are dying of famine. Thus India will become more and more impoverished, while the railroads are constructing; and famine may even depopulate the country before they are carried to any considerable extent.

34th. That the same money and time required to make one mile of high speed railway will be sufficient to make 100 miles of good river navigation, twenty-four of first class steam-canal, twelve of very good low speed railroad, twenty of an inferior kind of common road, and forty of perfect common road with timber bridges, or twenty-four with masonry works.

35th. That we have to deal with a present direct burthen on the country in actual payments for transit, of probably at least fifteen mil-

lions sterling a year, equal to three-fifths of the whole taxes; besides there being a loss of at least an equal amount on goods not carried: in all, thirty millions sterling, or much more than the whole Revenue.

36th. That by a judicious expenditure on communications, such a portion of this may be saved, as will relieve the country to the extent of the whole of the present taxes; while its effects in stimulating traffic, will be far greater than in the money saved.

37th. That the present railway between Bombay and Madras, if carried on at *both* ends at the rate of ten miles a year, (as hitherto at the Bombay end), will only be completed in forty years, and will cost, for a single way, about six millions sterling, (Rs. 80,000 (£8,000) a mile for 300 miles); whilst in the meantime, there will have been spent on transit by the present tracks, about sixteen millions sterling, (Rs. 10,000 (£1,000) a year per mile, on 800 miles for half the time); sufficient to lay an excellent low speed railroad sixteen times over.

38th. That in a very rich country already provided with a complete system of *cheap transit, high speed of transit* is the grand object to be sought; but that in a very poor country, paralyzed by utter want of means of transit at a moderate cost, *speed in forming a general system of cheap transit* is the grand desideratum to which everything else should give way.

39th. That what is the best economy for a country like England, is ruinous to India in its present state; in the same way as a carriage-and-pair is the ruin of a young apothecary with one patient a day, though it is a very economical expedient for a physician with more patients than he can reach on foot.

40th. That a more effectual expedient could not have been fixed upon to keep India in its present beggarly state, than to keep its rulers and all others interested in it, amused with laying down annually thirty or forty miles of fine railroads; while the whole country is starving for want of anything in the shape of cheap communication of any kind.

41st. That one of the greatest evils India labours under, is the cumbrousness of its ruling apparatus; and to increase the difficulty, even railways are carried on under ten separate authorities:—

1st. The Board of Control,
2nd. The Court of Directors,
3rd. The General Government of India,
4th. The Local Government,
5th. The Shareholders,
6th. The Managing Committee at Home,
7th. The Consulting Engineer at Home,
8th. The Agent in India,
9th. The Government Inspecting Engineer, and
10th. The Local Engineer.

And the progress hitherto has been much what might be expected from such a complex system.

42nd. That if we compare this with the simple effective plan followed in regard to the Electric Telegraph, the progress of which will no doubt correspond therewith—a single officer, active in his movements as his own electric sparks, sent home to make all arrangements in direct communication with the court—we can have no doubt as to which of the two plans is best suited to the circumstances of India, when demanding 100,000 miles, whether of communications or of telegraph.

43rd. That the interests of shareholders coincide with those of the country; as Capital employed on cheap communications will return ten times that laid out on expensive ones. A lack of rupees (£10,000), spent on a mile of high speed railway, would save Rs. 12,000 (£1,200) a year, out of the Rs. 16,000 (£1,600) at present spent in the transit of 100,000 tons of goods; whereas, the same sum spent on ten miles of cheap railway would save Rs. 1,00,000 (£10,000) a year; and if in both cases half the saving were taken by Government in tolls, the respective profits would still be six, and 50 per cent.

44th. That the profits on money invested on common roads would be as great as the above profit on cheap railways, and much greater if invested in canals.

45th. That the field for employment of Capital, giving enormous returns, is unlimited in India; it is represented by fifteen millions sterling clear saving that may be effected on the cost of the present transit, representing a Capital of 150 millions at 10 per cent. The whole expenditure on railroads in England was about two hundred millions sterling, yielding only 3 per cent., or six millions a year; and England has now before it a clear field for the employment of Capital that will yield at least two and a half times as much as the railway Capital in England; and if content with only three or four times as much per cent. in profit as the English railways yield, the shareholders will still make India a present of many millions a year.

46th. That the present high speed railways may demand 5,000 tons of rails a year, whilst the plan proposed, of opening the country at once by means of cheap railways, will take fifty, or 100,000 tons a year; a quantity which must have a perceptible effect on the iron trade.

47th. That it is impossible to estimate the effects on England of throwing open all India by cheap transit, and relieving it from a burthen of fifteen millions a year, thus making it at once a comparatively wealthy country, and universally a market for English manufactures.

48th. That all classes of people in Great Britain, who care for the temporal and spiritual welfare of India, are interested in this undertaking. The East India Directors, the Abolitionists, whose object is to

take off the premium on slave labour by bringing in cheap Indian cotton, the Societies for spreading the Gospel through India, the Manchester, Sheffield, Birmingham, Yorkshire manufacturers; is not almost everybody in England in fact personally and deeply interested therein?

49th. That there is nothing to prevent this opening of the country being entered upon at once; the money, the materials, the country, the people, everything is ready. The court have but to issue the orders, and the communications may be commenced at one hundred points, and opened almost as soon as O'Shaughnessy can lay his telegraph.

50th. That everything depends upon our giving up this idol of *speed.* Besides some thousands of miles of good water communications, which can be had at a small outlay if speed is given up, cheap railways can be laid with steep gradients, sharp curves, light rails, a narrow guage, timber viaducts, &c., with little labour and at small cost; so that 3,000 or 4,000 miles can easily be completed in a year.

51st. That nobody is more interested in these cheap and rapidly-laid railways than the shareholders in the high speed railroad themselves; because, by means of them, the great mass of the traffic may at once be brought upon such few miles of complete railroad as may be finished, instead of waiting for forty or fifty years before one main line is completed. Wherever the high speed railway shareholders work therefore, they ought to begin by laying over the whole length of the line a cheap railway, which would immediately give them enormous interest for their money.

52nd. That in respect of the main object in every country, whether rich or poor, viz., *cheapness of transit,* nothing can compare with internal navigation; and that without this, a continental country must, owing to the great distances to be traversed in it, be almost entirely cut off from foreign commerce.

53rd. That even if there were railroads all over India, it will still be worth while, nay necessary, to open lines of navigation; because, after all that can possibly be done with railroads, goods cannot be carried nearly so cheaply by rail, as by water.

54th. That generally the cost of transit by different communications in India may be thus estimated:—

By the present unmade roads	3	annas	($4\frac{1}{2}d.$)
By perfect common roads	8	pice	($1d.$)
By first class railroads (high speed)	4	,,	($\frac{1}{2}d.$)
By cheap do. (low speed)	2	,,	($\frac{1}{4}d.$)
By unimproved rivers	4	,,	($\frac{1}{2}d.$)
By improved do.	2	,,	($\frac{1}{4}d.$)
By do. down stream	1	pie	($\frac{1}{8}d.$)
By steam-canals	$\frac{1}{2}$	,,	($\frac{1}{16}d.$)

55th. That the line of communication for goods between Europe and the upper valley of the Mississipi depends entirely upon the inland water communications, whilst it is not in the least affected by the railway. The struggle is exclusively between the Erie and the St. Lawrence canals; and that, too, in a country *where canals are closed for five or six months in the year by frost.*

56th. That Agra, being only 500 feet above the sea, (1,200 miles up the river), forty anicuts (weirs), which might cost on an average three lacks (£30,000), in all 120 lacks (one and one-fifth millions sterling) would give, at the rate of Rs. 7,500 (£750) a mile, a perfect steam-navigation with still-water for eight months in the year; much superior to the Mississipi, as being without its disadvantages.

57th. That in Berar, cotton is grown at $1\frac{1}{4}d.$ a lb., while the people are fed on rice, which there costs four times the sum for which it could be brought from Rajahmundry by the Godavery; and it is the same with the salt they use.

58th. That in communications we have this paradox, that a diminution of cost of transit, however small, may produce an effect, however great, in creating a demand. Upon a reduction of cost of transit, by as little as five rupees (10*s.*) a ton on 1,000 miles, may depend whether it is profitable or not to convey some great staple article of commerce to another mart. For instance, upon this may turn the sale, and consequently the cultivation of an article of commerce, to the amount of a million tons a year, thereby bringing into a country an income of suppose ten millions sterling a year.

59th. That in so cheap and populous a country as India, the whole foreign trade (to say nothing of that which is internal) hangs upon the *cost of internal transit.*

60th. That whatever is ultimately done, there is *at present* only one object to be kept in view, viz., *speed* in *making* communications, and that whatever is ultimately done, there is one thing that must *now* be rejected as destructive of all we aim at, viz., *great speed* in *working* the communications. If we give up this for the present, we can do anything and throw open all India to every wholesome influence at once; but if we persist in aiming at this *first*, we can do nothing, however busy we may appear to be.

APPENDIX
No. II.

Thursday, 20th June 1878.

MEMBERS PRESENT:

Mr. Agnew.	Mr. Sampson Lloyd.
Sir George Campbell.	Mr. Mulholland.
Mr. John Cross.	Mr. Onslow.
Lord George Hamilton.	Mr. Edward Stanhope.
Mr. Hardcastle.	

LORD GEORGE HAMILTON, IN THE CHAIR.

Lieutenant-General Sir ARTHUR COTTON, K.C.S.I., called in; and examined.

Chairman.

2201. BEFORE you give any evidence to the Committee, perhaps you will be kind enough to state to the Committee what service and experience you have had in India?—I went to India in 1821; in 1822 I was appointed to what was then called the Maharamut Department, that is to say, the Department of the Repairs of Public Works; I continued there until 1824, when I went to the Burmese War. In 1826 I was re-appointed to the Tanks Department, and I continued in that until I left India in 1853, and I returned again in 1857 for two or three years.

2202. Since you left India you have taken a very lively interest, have you not, in this question of public works?—Yes.

2203. It would perhaps be convenient if we were to divide into certain heads the evidence which you wish to give, and therefore the first question which I would ask you is, what is your opinion as regards the remunerativeness or direct returns from public works in India?—This is my first point, that in this case the great question is not what are the direct returns to the Treasury from any public works expenditure, but what is the general and total effect upon the country; that is, the Government are not in the position of a private company, but of statesmen. I grant that it is a question which must be attended to, whether a work presses upon the finances or strengthens them, but I beg to offer that it is not the first question or the most important one; for instance, the Tanjore works have been the principal means of raising the condition of two and a quarter millions of people to such a state of wealth and prosperity as we may safely believe no district of India ever attained to

before, and have besides secured the population from famine up to this time. They have indeed, at the same time, been probably the chief means of raising the Revenue from 420,000*l.*, previously to the works, up to 750,000*l.* at present, an increase of 330,000*l.* a year. Now, though a third of a million in one district out of 160 is really something considerable, it is surely quite secondary to the effects upon so large a population. This is an instance of what has been done; and, on the other hand, we may take an instance from what has not been done. We have the most dreadful accounts of a fatal fever raging round Calcutta for many years which has occasioned a frightful mortality (I propose to read some extracts from official papers on this subject); they attribute this calamity to the want of the regulation of the water, affecting the case in two ways, first, in draining the tract in the monsoon and supplying wholesome water for the people; and, secondly, by irrigation providing better and more abundant food, for the accounts of the utterly inadequate feeling of the people are perfectly astonishing. Now, in this case, surely the relief of the population from this dreadful fatal fever, and from absolute want of the necessaries of life, is the primary point, and the question of whether works returned three or five per cent. a secondary one. I beg to offer one more instance: Mr. Leslie, the Engineer who constructed the East India Railway, has shown that it carries one-tenth of the Eastern traffic, leaving the rest to go 300 miles round by the rivers; this is besides the Western traffic. Surely the nine-tenths that are left behind are of more importance than the one-tenth that is carried, and than the six or seven per cent. that the railway yields.

2204. I believe you wish also to express your views as regards transit and the cost of transport?—I may just repeat that my first point as to the great question is, what are the general effects of the works upon the whole community, and not the mere money returns to the Treasury. The next point that I would wish to offer some remarks upon is transit. My great point in this matter is, that I have so far changed my former views that I consider this the primary question in the material improvement of India, and before that of irrigation in importance. Now we have before us this most awful fact, that from 10 to 25 per cent. have perished in Madras districts, while there was food enough in India, and therefore solely from want of efficient transit; I am afraid we must reckon that out of the 40 millions affected by the famine in Madras, Mysore, Hyderabad, and Bombay, four or five millions have perished, after spending 120,000,000*l.* on railways, besides incurring a debt on them of 50,000,000*l.* Let us look at these two facts, that one of the most successful railways leaves behind nine-tenths of the present traffic instead of creating as much more, and that 4,000,000 perish in a famine while there is food in India, and consider whether the subject of transit is understood. What are the great points in this question? Surely the first of all is, How much we have got to carry. Now I have read scores of Blue Books and other official papers on this subject, and have not yet seen one that touched upon this point. What should we think of a man who was preparing to travel and forgot to consider whether he had to provide carriage for an ass load or an elephant load. So a Railway Engineer, as soon as he has finished his railway, writes to show that after twelve years' trial and an expenditure of 3,000,000*l.*, besides a debt of 1,000,000*l.*, it leaves behind one and three-quarter million tons of goods, and causes a loss of 2,000,000*l.* sterling a year for want of effective

transit; but we do not make lines of transport merely to carry what was carried before. The great effect of efficient means of transit is to create traffic; that is, to enable producers to send to a distant market what was before unsaleable, because he could not reach that market at a practicable cost of carriage. On the main line in Godavery there was formerly carried some 10,000 tons; now that they have effective transport, 200,000 tons are carried. So on the line from Calcutta to Loodiana, the question is not about the 300,000 or 400,000 tons the railway carries, nor about the greater quantity that still goes by the river, but about the millions of tons which a healthy development of the country requires; thus the wheat trade entirely depends upon the cost of carriage being reduced; by land it costs 2*l.* a ton for 1,000 miles, or 1*s.* a bushel, while all but an insignificant portion of this would be saved by effective water carriage; and upon this 1*s.* a bushel will constantly depend whether England is supplied with wheat from the United States or from India. And so with all sorts of things; with a thoroughly good means on this line I have no doubt that 3,000,000 tons would very soon be carried, and what it would come to ultimately, who can estimate? Now this is quite certain that a railway could not convey 3,000,000 tons. The next point in this question is how to carry cheaply; if we have to carry 3,000,000 tons to Loodiana, at the average railway charge of a penny, it would cost 7,000,000*l.*, and at their lowest charge of a half-penny, three and a half millions. If carried by steam-boat canal at one-tenth of a penny, it would cost 700,000*l.*, a difference of two and three-quarter millions a year, the interest of 70,000,000*l.*; but Mr. Leslie shows that there would be a saving on the Eastern and Western traffic together of 2,000,000*l.* (on the present traffic) on that first 130 miles, as compared with what is now paid; that is the first 130 miles from Calcutta to Goalundo, the confluence of the Ganges and the Bramapootra. Thirdly, let us compare more particularly the two means, land and water carriage: we have first the capital required; the railways have cost from 6,000*l.* to 24,000*l.* a mile, and the canals fit for steamers of 250 tons, from 1,000*l.* to 6,000*l.* Secondly, the cost of carriage by the two means: I feel sure that on long lines the expenses will not exceed one-tenth of a penny; more likely one-twentieth. In the United States the cost is stated to be one-eighth. In India, with men's wages at 4*d.*, against 6*s.* in America, it could not be half what it is there. In Godavery, with little boats and short distances, it is one-eighth. Thirdly, the quantities: the railways could not carry even the insignificant quantities required in the famine, while canals could certainly carry an unlimited quantity; besides these essential and insuperable defects in railways, there are several others of the greatest importance, such as being able to load only at stations, &c.

2205. I believe you wish to compare the direct results of the two divisions of public works, namely, railways, as against irrigation, with navigation?—Yes. The railway account now stands thus: cost of works, 112,000,000*l.*; cost of land, about 8,000,000*l.*; debt in 1869, 21,000,000*l.*, now 50,000,000*l.*; total, 170,000,000*l.*; for which we have about 7,500 miles, or at the rate of 23,000*l.* per mile; and the present cost to the Treasury is, interest on share capital, four and a half millions, and on land and debt at 4 per cent., 3,000,000*l.*; total, seven and a half millions; from which deducting net receipts, four and a half millions, leaves 3,000,000*l.* a year as the loss on the money sunk. The

Capital spent on the waterworks, including the Toombudra, is 16,000,000*l.* The accumulations of interest against the Buree Dooab, the Ganges, and other canals, are much more than balanced by those to credit on the Cauvery, Kistna, and Godavery works, which have at least 10,000,000*l.* to their credit, leaving a balance in their favour of 5,000,000*l.* ; so that the money sunk may be taken at 11,000,000*l.* ; the interest of which at 4 per cent. is half a million ; against which we have a net profit over working expenses of about 1,000,000*l.*, leaving a net gain to the Treasury of half a million a year on irrigation works, against a net loss of 3,000,000*l.* on the railways. I, of course, cannot state all the particulars here, but this is undoubtedly a substantially true statement of the case. One of the witnesses has correctly insisted upon this calculation of the accumulations of interest on the Ganges canal. I heartily approve of this honest dealing with the matter, for it is the truth ; and when this principle is applied to the other irrigation works that have paid enormously beyond their proper interest, and to the railways, it brings into a strong light the difference of the results of the two modes of spending money in respect of this minor point of the direct returns to the Treasury.

2206. What is your next point?—The fourth main point which I wish to refer to is, the total results to the country. And first, with respect to the grand point of all, namely, the saving of life, one thing is quite certain, that so far as our irrigation works extend, they have completely protected the people from death by famine, and we have no reason whatever for supposing that they will not always do that. On the other hand, without exception, the railways have totally failed in this essential point. Many millions have died in all the districts through which railways were in full operation, especially in the last famine in all the Madras districts, on each of which, on an average, 1,000,000*l.* has been spent in this way, besides the millions that were spent on the railways that connect those districts with the tracts from which the grain was brought. Millions have perished in this dreadful way. There can be no possible question, therefore, on this point, that in this fundamental particular the irrigation and navigation has been a complete success, and the railways a complete failure. In the evidence of one of the witnesses before this Committee, it was said, "But then you must consider that whereas railways have no drawback whatever, &c.," could words be in more direct contradiction to facts? Compare them with the unquestionable statements that in those very districts in which 27 per cent. have died, a million had been spent on railways. And the last Railway Report states that the profits on those Madras railways were 230,000*l.*, and the guaranteed interest 500,000*l.* ; a loss of a quarter of a million, besides the interest on the price of land and the debt, now amounting together to about 10,000,000*l.*, making together an annual charge upon the Treasury of near three-quarters of a million. This loss of money, with that of about 3,000,000 of lives in Madras alone, are no drawbacks whatever. How inconceivable it is that such things should be said in the face of facts that every Member of the Committee knows, and everybody else. Under this fourth main head, my second point is the results of the two kinds of works in ordinary years. What is the ordinary increase due to irrigation?—Up to the present time no information seems to have been given to the Committee on this point, which is very strange, for surely it is a fundamental one. How can we possibly form a

judgment on the advisableness of irrigation or otherwise, if we do not know what benefit it gives in this primary respect? In Godavery we used to reckon that it increased the crop in grain only, by twenty rupees an acre, at least. In the North-Western Provinces, by a paper I saw, I think by General Dickens, where it was carefully investigated, the increase was reckoned at fifteen rupees. And by a paper on the results in Orissa, written some years ago, it was stated at something under that. I see now that it is reckoned at less; in very favourable years, as respects rain, not more than four rupees; but this, I have no doubt, was where they did not empty the fields of rain-water and fill them with the rich river-water. At one time they were doing this in Midnapore, but I do not know whether they learn to do this generally. I do not think that it can be less than 1*l.* a ton on an average of years there. Taking the lowest of these, it is at 7 per cent., the interest of 14*l.* per acre; but this is besides the cheap transit, the drainage, the security from river floods, the abundance of forage, the supply of wholesome drinking-water, &c. The cheap transit alone, allowing for half a ton carried fifty miles with a saving of only 2*d.* a ton a mile, would be two rupees an acre for the carriage of the produce in grain alone, so that the whole saving from this must be more than the whole water-rate. But what should we say to the effects of passenger transport? In Godavery they are carried at eight miles for 1*d.*, and the canals are crowded with passenger boats, as one of the witnesses has already shown. This perfect liberty of intercourse is the very life of the district. If all India were supplied with such cheap passenger transport, where the passengers could be taken up and put down anywhere, and every one was free to travel either in his own boat or by any passenger or goods boat, at any hour of the day or night, and at any speed, without having to wait for a train or go to a station, it is impossible to estimate the benefits it would confer. On the other hand, the railways carry only, on an average, 190,000 tons per annum; quite an insignificant quantity, compared with that required on these great main lines; only as much as is carried on the main canal in Godavery, an isolated patch of country far from any of the great cities; and, as we have seen, only one-tenth of the present traffic on one line of which Mr. Leslie speaks, and this at a cost which does not at all meet the wants of India. They also carry on an average 350,000 passengers, or 1,000 a day; certainly not a fifth part of those who would travel on these great lines if they could travel cheaply, and without all the drawbacks of the railways. One proof how sadly the railways fail in the passenger traffic is, that the average price of a ticket is 20*d.*, showing an average distance of seventy miles, so that they scarcely touch the small local traffic. In England, the average price of a ticket is 1*s.*, making the average distance for all England ten miles, against seventy in India; a most remarkable fact as to the real operation of the railways, and, even if they did really accommodate the traffic on the main line itself, this is an insignificant thing, compared with the traffic throughout the country. What would the state of Godavery be if, instead of the whole delta being pervaded with transit at one-eighth of a penny over 500 miles of irrigation canals, the whole 700,000*l.* had been spent on eighty miles of railway, carrying at a farthing. Even if this 700,000*l.* had given Godavery nothing but such a passenger transport over 500 miles, it would have been a benefit immeasurably greater than that of eighty miles of railway. The fact is, we

must state the effects of the railways rather by what they do not do than by what they do. They do not provide food for man or beast; they do not carry the great traffic of the country; they do not carry cheap enough to answer the main purpose; they do not touch the local traffic, either of passengers or goods, perceptibly; they do not pay the interest of their cost and debt; they do not drain the country; they do not provide wholesome drinking-water; they do not prevent fever; they do not create traffic; and what is a most important point, in case of disturbance it will be impossible to protect them, because you cannot patrol them with trains of armed men while the ordinary traffic is running. Of all helpless things in the world, railways are the most helpless in times of disturbance. In short, as a chief Railway Engineer said to a friend of mine, they are not suited at all to the circumstances of the country, and India is, at this moment, in as great want of a complete system of water-carriage, as if no railway existed.

2207. What is your next point?—My fifth main point refers to the objections which are often started to irrigation with navigation. First fever; my answer to this objection is, that I have lived all my life in the paddy fields, and never had myself, or knew of an attack of fever in others, from irrigation. I have had innumerable fevers in India, but always in the unirrigated districts. No doubt there are instances of fever produced by irrigation in some localities; but they certainly are the exceptions, and not the rule; and we know that in many cases they have been owing to incomplete drainage. But on the other hand are there no fevers for want of regulation of the water? Beyond all comparison the worst fever I ever heard of is that which has pervaded Bengal for years. I have two reports by Colonel Haig and Mr. Saunders, a medical Inspector, on this subject, containing the following expressions: "The frightful mortality;" "of the poor suburban villagers scarcely one regained his former condition, and large, very large numbers of them, died;" "I have myself seen whole mohullas deserted in Burdwan, where I am told three-fourths of the whole community had died," and so on. Now if this awful mortality was going on for years under the very eye of the Governor of Bengal, who of course did his utmost to check it, we must conclude that if there is fever in some cases from irrigation, there is incomparably more in others from want of it. It is very remarkable that in the former evidence there is no mention at all of this, the most terrible fever we have any account of in India. On these reports being received by the Viceroy, he ordered the matter to be thoroughly investigated, but nothing has been done to this day, though both the Engineer and the medical officer most urgently insisted on immediate measures being taken to regulate the water, and by drainage to carry it off in the monsoon, by irrigation to improve the food of the people, and to supply them with wholesome drinking-water. I beg most earnestly to press upon the Committee the perusal of these two terrible reports, that they may have some idea what Bengal is suffering from want of irrigation and its accompaniments. These reports were dated in 1873. The next objection to irrigation is the efflorescence called *reh*; my first answer to this also is, that I never saw an instance of it. It also is quite an exceptional thing, and therefore is no more a reason for giving up irrigation than a death on a railway in England is an argument for abolishing railways here. A third is, diminished produce; the answer to this is, that at least 20,000,000 of acres from one end

of India to the other have been irrigated for hundreds of years, both from rivers, tanks, and wells, without any diminution of produce; so that this also must be quite exceptional. This is the way the Trichinopoly ryots in an address to the Governor of Madras, after hundreds of years of irrigation of the same land, speak of the effects of irrigation: "All which works (the great irrigation works of their own and other districts) have converted the tracts affected into" (What? Depopulated deserts? No.) "into scenes of matchless fertility and wealth, and have for ever protected them and the neighbouring districts from the disaster of recurring droughts." If, therefore, there are instances of injury of this kind from irrigation, the exceptional case should be investigated. A fourth objection is the refusal of water. This is also quite exceptional. In Madras, out of thousands of works, we have only had one single instance of any difficulty of this kind. Of course, therefore, there can be but one explanation of the matter, namely, that there has been some egregious blunder in the management. This is now acknowledged by the Madras Government, and they have set about heartily to put things to rights by sending a special officer whose sole business it is to remove all obstacles, and take measures that the water is no longer allowed to run to waste. In a Government Minute it is written, "The Company have real cause of complaints." Again, "The Collector of Kurnaul reports that the Manager of the Company had real cause of complaint in consequence of the wording of the vernacular instructions, &c." These are extracts from the Government Minute. The Governor accordingly appoints a special officer selected on purpose for this duty. In the only other instance of this difficulty in all India, that is in Orissa, I have no doubt that the same thing is required; but there the difficulty is already in a measure removed. My letters say that near 100,000 acres were watered last year, and it is expected that as much will be taken on a five years' lease this year. But here the difficulty is terribly aggravated by the wretched state of the Revenue arrangements, as has been pointed out by one of the previous witnesses. Of the terrible state of these districts under the zemindary system I have not time to enlarge here, but scores of persons witness to them. I was first instructed in these things by a former Governor of Bengal, whose account of the state of things agreed with what has been given in evidence to the Committee, though, of course, he spoke somewhat plainer in private. I need only refer the Committee to the two reports I have before spoke of, from which they cannot but form some idea of the dreadful mistakes that have been made in some cases in India, in the midst of our undoubted generally most able, faithful, and successful rule there. But when we see that under the very eye of the Viceroy and the Governor of Bengal, two such terrible evils as this most virulent fever from want of irrigation, and the loss of two millions a year, from the want of effective transport on a single line of 130 miles, exist in the immediate neighbourhood of Calcutta, the Committee cannot but see that unquestionably such an inquiry as this, and that by the Famine Commission in India, is peremptorily required. Another objection to these great works that has been made before this Committee is the great expense of locks in making the canals navigable. This is a mistake. The cost of locks is about 500*l.* a foot of lift, and as the fall of the country from Loodiana to Calcutta, for instance, is less than a foot a mile, the cost of lockage would be only

500*l.* a mile if the whole line were to be reduced to dead levels, which it would not, so that the whole cost of that line will not be more than 3,000*l.* or 4,000*l.* a mile, against 24,000*l.*, the total cost of the railways. On the line of the Poornah, to connect the East and West coasts by the line of the Godavery, the fall is about three feet a mile; but, on the other hand, on ninety miles of the Godavery and Kistna canal, there is one lock of twelve feet. The cost of the locks, therefore, on all the main lines of India is by no means a serious objection. If the canal, north and south along the line of the Carnatic, to supply the tanks, is constructed, there will be 600 miles without a lock. Another objection that has been started is the evaporation of the water; this is quite an insignificant matter. Another objection is the great cost in upland districts. My first answer to this is: "But what has this to do with the question of irrigating the hundreds of millions of acres in the plains of the Ganges, the Indus, and the Bramapootra? The practical man does not trouble himself with what cannot be done till he has finished all that can be done. But, further, we have already a perfect instance of up-land irrigation in the grand work of the Madras Company; here they distribute 400,000 cubic yards an hour for seven months, making 2,000,000,000 cubic yards per annum, sufficient for 200,000 acres of rice and 600,000 acres of dry grains, for 1,600,000*l.*, giving an average of 2*l.* an acre, where the increase of produce will be at least 2*l.* per acre also, or 100 per cent. There are hundreds of millions of acres of up-land country similar to this. A further answer to this objection is, that all over an immense part of the upper country there are innumerable works of irrigation now existing, both tanks and canals. I may refer to Meadows Taylor's life to show what both intelligent Europeans and Natives think of irrigation works and their practicability in the upper country. The whole of the country that the Trichinopoly ryots were speaking of irrigating is of this kind. They were not speaking of Delta land; they were asking the Government to irrigate the up-land. I think these are all the objections which have been raised to irrigation and navigation, and I beg to urge the answers of an experienced man who has surely shown himself in some measure a practical man, by what he has been allowed to do. There have been great men connected with India in past times, both black and white men, who were not a bit afraid of Engineers and cold water, resolute men, and I hope we shall see such again if we live.

2208. There was certain evidence given by previous witnesses with which I believe you do not agree; will you state to the Committee the points upon which you differ from the preceding witnesses?—First, with regard to the Cauvery works, it has been stated that they do not return 87 per cent., as stated by the Madras Government, but no proof whatever is given of this. It is a bare unsupported assertion. I think that an official paper ought to be, at least, met by some figures. It is also stated that there has been very little additional land irrigated since the new works. There is nothing whatever to support these assertions. I have not the extent of irrigated land before the works, but I have the actual returns of the district showing the wet assessment. It was in 1832, 238,000*l.*, which, at an average of five and a half rupees per acre, gives 420,000 acres of Government irrigated land. In the evidence this was stated at 800,000 acres. There can be no possible mistake about the extent which I state. It is taken from the official returns of

the district. The present wet assessment is 370,000*l.*, and the area 740,000 acres; an increase of 320,000 acres in the Government land alone, besides that in the zemindary lands. The total irrigated land is given in the Administration Report at 920,000 acres. I think this still omits some class of land, but no further information is given by the report. This increase of 320,000 acres is besides a proportional increase of zemindary lands, which would be about 80,000 out of 180,000, making 400,000 acres. Besides this, there is the increase in South Arcot and Trichinopoly, in which districts about 150,000 acres are now irrigated from the Delta works, of which about 100,000 acres is new, as I have reason to believe, making about 500,000 acres in all, added to the area irrigated by the Cauvery Delta works. A great deal of land was not cultivated before, and it has only been cultivated in consequence of being irrigated. The difference between dry and wet assessment is, there, four rupees, so that the total Revenue due to this would be 200,000*l.*, a year. But this does not all come into the Treasury, because some of it is zemindary land. The difference between the actual assessment in Tanjore alone of Government lands, 140,000*l.*, is certainly all due to the works, and of course some party of the dry assessment of the same land. The Capital expended in Tanjore alone is stated at 134,000*l.*, and the net Revenue due to the works at 116,000*l.*, or 90 per cent. The total Revenue of Tanjore was, before the works, 420,000*l.*; it is now 750,000*l.*, a difference of 330,000*l.* All the assertions in the world will not get rid of these plain facts. This return of 90 per cent. is, besides, all the indirect returns from the general improved state of the district. It is quite certain that a large portion of the whole increase of 330,000*l.* is due to the irrigation. The whole increase of the Revenue of the Delta, including Trichinopoly and South Arcot land, is about 400,000*l.* a year, the interest of ten millions, which will give some idea of the effects of irrigation in mere money returns to the Treasury. The total irrigated area in the Delta is at least 1,100,000 acres. There were in the Delta before at most 500,000 acres very uncertainly irrigated; there are now 1,100,000 acres in a highly complete state of irrigation. The increase of produce due to irrigation is certainly 2*l.* an acre, making a total of a million a year. What can be the object of trying to get rid of these plain facts? So with Godavery; the actual cost there has been 700,000*l.*, and the increase of Revenue of the district 350,000*l.*, of which almost all is entirely due to irrigation and navigation. The Government Report for 1875 gives the net return at 175,600*l.*, or 25 per cent. The returns of 21, 15 and 87 per cent. mentioned in previous evidence is besides 4½ per cent. for Government interest. General Strachey some years ago, when he reported upon this, made the net percentage 28, and Mr. Thornton made it 40. I am quite sure he is nearest the mark; but what does it signify whether the return is 25, 28, or 40? This is not the question. The real and essential fact is that the works are returning enormous direct profits to Government, and by an increase of crop of 2*l.* on 700,000 acres, at least 200 per cent. in crop alone, besides cheap carriage and all other benefits. The assertion that the old works were part of the new is also quite false; they form no part of the new works. I may give here the conclusion of Mr. Morris's official account of the district: "At one time the district was brought into a state of extreme impoverishment and distress. It was desolated by famine and misgoverned by the numerous landowners and their advisers. Since the

introduction, however, of the admirable system of irrigation, it has brightened and revived; famine is unknown; the people are prosperous and contented; it is the garden of the great Northern province; its Revenue, instead of being reduced to the verge of bankruptcy, is more elastic than ever; its population has more than doubled; the material prosperity of its inhabitants is proved by their being better fed, better clothed, and better educated than formerly; its commerce has flourished, and its trade increased to a marvellous degree, and it may be confidently asserted that it is in as peaceful, happy, and prosperous a condition as any part of Her Imperial Majesty's dominions." I ask again what can be the object of trying in vain to get rid of these palpable facts. This district, from having been the very lowest, is now quite the highest in the whole 160 districts of India. Surely our wisdom is to be encouraged by this, and see what can be done to raise all the others in some degree, at least, to the same state of prosperity. Compare the report of this district with the following extracts on the state of Bengal. In the districts west of the Hooghly, Colonel Haig thus speaks of the state of things: "It would seem that the daily allowance per head is not more than a pound of rice, but in many years it may be much less than this. The present year's crop, for instance, is reckoned as only half a crop. If there is any truth in figures, we surely need nothing more to explain the frightful mortality which has accompanied the present epidemic. I can urge nothing more important than such a thorough investigation as would set these questions at rest, and furnish a satisfactory reply to the fundamental inquiry, what is the actual condition of the Hooghly peasantry? Are the high rents there in anywise an index of prosperity, or, on the contrary, of great and general poverty, of the state of things in which wealth accumulates and men decay? Is the population being gradually reduced, by a process of slow starvation, to a condition in which it must inevitably be swept away wholesale by endemic disease. I cannot myself but fear that such is, to a considerable extent, the case." If I had set myself to invent words that would place before the Committee a comparison of the highest and lowest state of the native population, how utterly I should have failed, in comparison of these terrible words. What has made the difference between these two tracts? In the one we had able, faithful Governors and subordinate Revenue men, who both laid a sound foundation in Revenue organization, and also called in the Engineer to regulate the water; in the other the Revenue foundation was utterly rotten, and the whole power of the authorities was exerted either to prevent the Engineer attempting anything, or if they could not do that, at least to obstruct him at every step, and paralyse all his operations by preventing anything from being carried to completion. The expensive head works in Orissa executed, and then the distribution works stopped in the middle; the canals begun at both ends, and then the link to unite them, and allow them to effect anything refused, and so on. One of your previous witnesses stated that he "was perhaps a little afraid of once letting in one Engineer and his schemes, for I did not know 'he said' where he would stop." He certainly had abundant cause to be afraid, for I do trust that if he had been called in he would never have stopped until he had done his utmost to sweep away this inconceivable blot on our escutcheon in India, and compel the official historian of the Hooghly district to give such an account as we have of Godavery. Colonel Haig goes

on to tell of the desperate efforts made by the ryots here to secure by any amount of labour, every drop of water, utterly destroying the drainage of the country, &c., and how there is nothing possible for the case but a complete system of irrigation and drainage, &c. But, as I have said, no words of mine could show you as these reports do the terrible consequences of having administrators who are incapable of appreciating and making use of Engineers; and I must again most earnestly entreat you to read these two sets of papers, Mr. Morris's account of Godavery, and Colonel Haig's and Mr. Saunders' account of Bengal, and then judge whether administrators who dread Engineers as the greatest evil districts can suffer under, far beyond famine, slow starvation, and fever, leave the best results behind them, or those who account them after wise Revenue organization the next great essential for the cure of the evils of India, but I must go on to the remaining mistakes that have been made in the previous evidence. The next point is tanks. The truth about these works is that they are invaluable in nineteen years out of twenty, or more, but that they have a serious defect, namely, that they are not supplied from the great rivers, in consequence of which they almost all failed in the late famine; but this is one of our failures. We have neither put these works, with some important exceptions, in a thoroughly effective state of repair, nor have we used our immensely superior power to supply them where possible from the great rivers, while a great number of them can be so supplied; and this is undoubtedly one of the most essential works that the Government can undertake immediately; namely, the thorough repair, enlargement, and improved supply of these grand works. Many thousands of them can be supplied from the rivers rising in the Western Ghâts at a practicable cost. They are situated at every level from near the summit of the country near Bangalore, 3,000 feet above the sea, and in every kind of situation, in the plains and the hills. Many of them are most noble works, from sixty feet deep downwards, and containing from 100,000,000 cubic yards. There were certainly great men in India in those days in high places; not like boys with guns which they are afraid to let off, but men who could handle an Engineer without fear and could revel in cold water. Next, with regard to the proposed lines of canals; I really thought there was nobody who had been many years in India who did not know where ranges of mountains were, and where they were not. It has been stated in the evidence that there is a range between the East and the West coasts on the line of the Godavery and Taptee: there is no such thing. The water-shed between the Poornah and the Wurda is without the sign of a hill, and it is just the same level as the line between the Sutlej and the Jumna, on which the canal is nearly completed. There is not a single serious natural obstacle from sea to sea. An expenditure of 700,000*l.* has very nearly completed the opening of the first 300 miles by the Godavery. The improvement of the Wurda has been carefully estimated by Colonel Haig at 2,000*l.* a mile, and the remaining 400 miles could probably be executed at 3,000*l.* a mile, but it has not been estimated; if it cost treble that, 9,000*l.*, it would be only what has been paid for the utterly insignificant coal railways just made in that part of the country, and which are not a hundredth of the importance of this grand connection of the two coasts, opening up the hitherto paralysed Central Provinces to all the stimulating influences of foreign trade. How any Commissioners could have gone on for years there, content to see

their province shut out from the world, and kept in such a state of poverty is to me most astonishing. It costs now 2*s.* 0½*d.* a ton per mile to convey the cotton by the railway, increasing the cost when it has reached the coast by a half-penny a pound. Think also of the ships and the country being deprived of the inexhaustible supply of coal of the Wurda coal field for the want of this communication. What is the use of all the treasures of India in the hands of men who are incapable of opening the way for their distribution. Think of the country being driven to the necessity of destroying all its manure for want of fuel, when there is an unlimited supply, but all useless for want of cheap carriage. Madras, Coconada and Surat ought all to be coaling ports at this moment, and millions of tons of manure ought to be supplied to the land instead of being burnt. Think of 500,000*l.* being spent on sixty miles of petty branch railways, where they are shut up for six months in the year, because there is nothing to carry, and on which there is not the least prospect of their paying interest, costing 9,000*l.* a mile, while the first part of the water line has been opened for 2,000*l.* a mile, and probably the whole 900 miles of river and canal connected with this line could be completed, including what has been spent, for 3,000,000*l.*, or at 3,000*l.* a mile, and who can estimate the effect of this upon the whole of Central India, giving immense value to all its treasures of coal, timber, oil-seeds, wheat, cotton, &c., and supplying it in return with salt, rice, and all sorts of foreign imports. I will venture to say that hardly any country ever underwent such a change from poverty and inanition as these provinces would undergo if they were thus thrown open to the world. Are we really never to see again in India men who are capable of comprehending such simple things as these? Six per cent. on that sum would be 180,000*l.* a year, equivalent to a tax of 4*d.* a head per annum on 10,000,000 of people who would be affected by them. There can hardly be a doubt that the increase of Salt Revenue alone in these tracts would pay the whole interest and expenditure of this line. And so with the line from Madras to Carwar; there are no mountains in the line. There is certainly there a greater ascent, about 2,000 feet, but this is no essential obstacle. The Madras canal has locked 450 feet of this already. Again, the West coast; it has been asserted in the evidence that there are mountains on this line. How unaccountable that such assertions should be made. There is no such thing. There are one or two slight cuttings required, the worst of which has already been executed by the petty native State of Travancore; another portion of this line has been enlarged by the State of Cochin. The whole work is a perfectly insignificant thing from Carwar to Cape Comorin. Is it too much to demand of the Committee to suppose that one who has professional knowledge and has seen the line knows more about it than one who is not an Engineer and has never seen it, who does not even take the trouble to look at the map to see where there are mountains and where there are not. The little State of Travancore, with a Revenue of half a million, has spent 100,000*l.* a year on this canal and other public works. I do wish we would condescend to learn a lesson from our native friends, or borrow some black Commissioners from them for our own provinces, and see if we could stir up our Governors to do for our vast provinces what they are doing with a thousandth part of our means. Then about the Orissa works. These

works have cost one and a half millions, and have been stopped in the middle. And the canal to connect Cuttack and the Upper Mahanuddy with Calcutta has been left with eighty miles in the middle uncut. The vast headworks of the irrigation which give command over a vast tract of country are now charged to quite a small tract, and the canal extends to sixty miles from Calcutta and then stops in the middle of the Delta, at nothing; and then the Engineer is charged with the failure of the works. Suppose the railways had been dealt with in this way, the great station at Calcutta built, and the road carried 100 miles, and another executed out of Benares, and then the works stopped, what would be the result? Is it not incomprehensible that such imbecility should be shown? In this way the cost per acre on irrigation may be increased indefinitely, and the traffic on the little bits of canal cut reduced to a tenth. What can stand before such a system? It is quite certain that if this communication with Calcutta had been completed it would have clenched the matter in respect of the irrigation, and would have enormously increased the value of every acre of land in the whole Delta. Even this bit of canal, ending at nothing, has paid last year three and a half per cent. in spite of the most absurd charge of three farthings a ton on the goods carried per mile. What would be the traffic on this canal if it opened the whole valley of the Mahanuddy to the immense market of Calcutta, and the charge per ton were one-twentieth of what it is? As it is, the traffic is 150,000 tons already, three-quarters of that on the great railway thoroughfares of India. The same with the Godavery navigation. It has taken twenty-five years to get 700,000*l.* for this work, 30,000*l.* a year, till the value of labour has increased three-fold, and the works have been again and again stopped entirely without notice, and at last put an end to just as they were being completed to a point where they would have opened up an immense tract of populous country; and then the perpetrators of such atrocities say, what men these Engineers are! It is now certain that if the first sum of 300,000*l.* roughly guessed before an estimate was made had been granted in three or four years, this 400 miles would have been completed twenty years ago, and before this the cost would have been recovered twenty times over by the incalculable benefit it would have conferred on many millions of people. The works are all but completed and have cost 2,000*l.* a mile against 20,000*l.* for railways, and 9,000*l.* for the petty railways in that part of the country. Think of 500,000*l.* being expended on sixty miles of railway, while money could not be found to complete this 400 miles of main communication. Again, it is stated that the river is only open for four months. I passed down it at Christmas from the second barrier near the end of seven months, and some years it is open much longer.

Sir George Campbell.

2209. In what kind of vessel did you pass down?—In a small boat, not a large goods boat; we are working steamers now on eighteen inches of water.

2210. Was this a boat which drew as much as eighteen inches?—Quite eighteen inches; quite a practicable cost would store water enough to keep this river open all the year with this additional benefit, that the cost of the water would be paid for over and over again by its use in the Delta, after finishing its duty of carrying. Now compare these proceedings with those in

the case of railways; while they cost ten times what this water-way has cost, can only carry very limited quantities utterly inadequate to the demands of the country and at ruinous charges, any number of millions could be found without a word of discussion as to where the money was to come from. Again, one of the witnesses talked about anicuts being swept away; he did not know that an anicut could not be swept away; again, he speaks of well-irrigation, and says nothing about the difference between either its cost or its quality as compared with the river or tank-water. Do these things make no difference; can we decide between well-irrigation and river, without knowing whether one is five times as valuable as the other or not, and whether one costs twenty times as much as the other or not. Well-water contains no nourishment for plants; river-water completely renews the land without any manure, and the comparative cost is thus shown: well-water costs 1*l.* for 3,000 cubic yards. The new tanks in Bombay will cost about 1*l.* for 12,000; the Ganges canal the same; the Toongabudra canal, 15,000; the Godavery, 120,000; and the Tanjore works still less. When any one asks, Why execute such great works; the answer is, Because we get this invaluable river-water at a fifth or a fiftieth of the cost of well-water, and manure the land into the bargain. I trust that these answers to the principal objections and mistakes of the previous witnesses will be sufficient to give some idea of the extraordinary fancies that men will gravely bring forward about matters that are out of their line. It does seem very extraordinary that it should not occur to them that they have no knowledge of the things. A letter was lately published in the *Times* by a lawyer, every sentence of which showed that he knew no more about irrigation and transit than I do about law. I must say that gentlemen on this Committee can hardly but be staggered by such assertions as that there are mountains in such a place where there were none, and such things, when there were no such there, because they would naturally suppose that, whether an Engineer or not, he could look at a map. I beg, before I conclude, to urge upon the Committee what I consider quite the most important point in this whole inquiry, and really the fundamental point. It is the transit question as illustrated by the Goalundo canal. I have taken the liberty of sending the honourable Members copies of Mr. Leslie's letter on this matter. He says that he estimates that if the canal costs 15,000*l.* a mile, it would yield 11 per cent. net, and save 840*l.* a year on the Eastern traffic alone, which would be doubled by the Western traffic; a total saving of more than 2,000,000*l.* a year on a single line of 130 miles, on which there is already a railway and a river communication, and that on the present traffic only, besides the great traffic it would create. He says, "The fact that the railway company has been in the field 12 or 13 years and has literally acquired only a tithe of the traffic, is an unanswerable argument in favour of the canal." Now it is twenty years since I was ordered to report upon this line, when I suggested a canal. Allowing Mr. Leslie's estimate, we cannot conclude that, including the new traffic, less than 50,000,000*l.* have been lost in that line during the twenty years. What has been the loss on all the main lines of India alone for want of similar cheap carriage, all the thirty years that the railways have been under construction, and what is the annual loss at this moment over all India from the same want? I am certain that, if this letter is fairly considered, and the unquestionable deductions to be made from it, the

only possible conclusion is that an annual loss is thus sustained equal to several times the amount of the present taxation. The Committee will perceive from what I have said that, in my opinion, it is impossible that a more complete perversion of the whole subject of public works could have been brought forward than the view taken by a previous witness. How could a question of greater importance be offered for decision by the Committee than this, which of these two views is the right one. The question is nothing less than whether Godavery, as described by Mr. Morris, or Bengal, as described by Colonel Haig and Mr. Saunders, is henceforth to be the standard by which all the rest of India is to be regulated. It is certain that not only the well-being of India, but to a great extent that of the whole Empire, is hanging in an essential degree upon the decision to which the Committee may come. If the standard of Godavery is attained, the Revenue will be increased two and a half-fold, the exports fifteen-fold, the imports ten-fold, the traffic on main lines twenty-fold, and the population placed "in as peaceful, prosperous and happy condition as any portion of Her Imperial Majesty's dominions." If Bengal is to be the standard, we must answer these questions of Colonel Haig's, "Are the high rents there in anywise an index of prosperity, or on the contrary, of great and general poverty, of the state of things in which wealth accumulates and men decay? Is the population being reduced by a process of slow starvation to a condition in which it must inevitably be swept away wholesale by endemic disease?" adding, "I cannot myself but fear that such is to a considerable extent the case." The sole cause of the difference between the two standards is undoubtedly that, in one case, there were rulers capable of organizing a wise and just system of Revenue management, and of making use of Engineers and water, and in the other there were not. The nature of the two tracts was exactly the same, rich Delta lands. I must beg to add one or two remarks; first, what are we to think of evidence in which interest and compound interest are insisted on, and most justly, in calculating the loss on the Ganges canal, but on the other hand not a word is said either on the accumulated interest in the vast profits on the Tanjore, Kistna, and Godavery works, nor on the enormous accumulations to loss on the railways, now amounting to 50,000,000*l.*, besides the cost of land, making, with the State railways, a total of sunk money of 170,000,000*l.*, with a clear annual loss to the Treasury of 3,000,000*l.* a year? And again, of the moderate fever on some portions of the irrigated lands, while not a word is said of millions of acres of irrigated land in various parts where the population are as healthy as anywhere in the world; and, on the other hand, while there is the most virulent and fatal fever by far that has ever been heard of in India, raging for years for want of irrigation works, under the eye of the Governor of Bengal? Again, what is to be said of the mention of a difference of opinion between two Engineers as to the probable cost of the Goalundo canal; but not a word about the chief Railway Engineer pointing out that on the highest estimate there would be a clear saving of 2,000,000*l.* a year on 130 miles, by the side of a railway which, after twelve years' trial, left nine-tenths of the goods to go 300 miles round by a bad river navigation, which takes six weeks, and this also under the immediate eye of the Governor? Again, what is to be said of the assertion, without a word or a figure in support of it, that the returns

were less than 87 per cent. in Tanjore; but not a word about the wonderful prosperity of the three irrigated districts, and the enormous additions that had been made to the Revenue there? Again, of the grain that had been carried by the railways for the famine; but not a word of the millions that utterly incompetent means had left to die; nor of the perfect freedom that the irrigated districts had enjoyed in the midst of all this dreadful calamity? Again, of the assertion that canals could not be carried across the water-sheds of the Poornah and Wurda, of the Kalanuddee, and Toombudra, and on the Western coast, on account of mountains, when no such mountains exist? Who cannot see that such evidence has been given under the influence of some fatal bias, that takes away all confidence in the whole of it? My further remark is, that the enormous returns of the Godavery works is in spite of every effort to prevent their being completed. It has taken thirty-two years to obtain 700,000*l.* for them; 20,000*l.* a year for works which from the very first have been a most prodigious success, and nothing would induce the authorities to carry them on with ordinary vigour. To this day money cannot be found to complete them, while the only dispute is whether they yield 17, 28 or 40 per cent.; and now, after thirty-two years, only 700,000 acres out of 1,000,000 are irrigated. If 100,000*l.* a year had been granted for five years, the whole Delta would have been irrigated twenty-seven years ago, before the great rise in the cost of labour, and the district would have been yielding a Revenue of about 750,000*l.* a year for the last twenty-seven years, making an addition of many millions in the Treasury beyond what they have returned. During this time there was not, for instance, the least question about supplying 500,000*l.* for the sixty miles of railway in Nagpore, which, it was acknowledged, would not pay 4 per cent. Who can be surprised that the finances of India are out of order when such terrible perversions of the funds at our disposal are allowed. And with respect to the Ganges canal, the sole cause why that work has not been abundantly remunerative from thirty years ago is the mistake in the projection, going up into the hills for the source, when there was no necessity for it. But for the time, and a million of money expended upon this, if the work had been led from below the hills, as the Lower Ganges is now, the canal would have returned high interest twenty-five years ago. If properly considered, these and other mistakes, instead of being discouragements, are the greatest possible encouragement. We may fairly hope that they will not be repeated. Another remark is on the carrying out of Mr. Leslie's canal, *in extenso*, up the valley of the Ganges. One of the witnesses has already spoken of this line of canal. The Sirhind canal brings the communication to near the Ganges. He says that "the Sirhind canal, with the Western Jumna and Agra, will complete a line to below Delhi, and so make a through communication with the seaboard, and the links that are required are comparatively small in number." A short link will connect the Lower Ganges canal with the Soane canals, which will extend to Monghyr on the Ganges, from which a link of seventy miles would carry it to the proposed site of the Rajmahal canal, which was to extend to Calcutta, the work of which one witness expressed great terror, but which I trust we shall yet see men of sufficient energy and capacity to carry it out. And with respect to the traffic on the Ganges canal, I have not been able to get the returns of this for several

years, but some years ago it was, I believe, about 100,000 tons a year. When I inspected it there were six essential defects in the navigation, one of them being that the bridges would not admit of loaded boats passing under them. This has now been remedied, but whether any of the others have or not, I do not know; but this I know, that everything was done that could be to discourage the use of the canal. When I was at Cawnpore boats were not allowed to pass through the locks into the Ganges, though there they were in perfect order. If the remedies in the navigation were completed, and the influence of Government were not exerted to prevent the canal being used, it would be one of the lines of greatest traffic in the world. The plain fact is that the dread of the officials is cheap transit; the whole power of the Government with its Treasury is to force the people to carry dearly a small quantity by the railways, rather than allow an enormous traffic to grow up at an almost nominal cost by the canals. This was what stopped the Damoodah canal from the coal fields to Calcutta, the completion of the Orissa canals, the Godavery navigation, &c. The newspapers have been full of notices of the utter failure of the railways to carry the trifling traffic that has offered. A gentleman connected with the Indian trade was telling me lately of the ruin caused by thousands of tons lying rotting at the stations, while the ships in multitudes were lying idle at the ports for want of it. Why not acknowledge at once that a most terrible mistake has been made, give India at once its ample and cheap water-carriage, and trust to the prodigious enrichment of the country by the additional value given to all produce by that means, for the increased use of the railways. A late Governor of Bengal was so afraid of this cheap carriage that he stopped the execution of the Western main canal from the Soane, though it was an essential part of the irrigation, to prevent its being used as a communication with the Ganges. The Viceroy overruled this, and it was ordered to be continued. The officer in charge, knowing what efforts would still be made to stop it, placed men on the whole length of it at once, but before it was finished orders came from home to stop it, and it is left in an unfinished state to this day. It is absolutely necessary that the Committee should know those things, that they may understand what cheap transit has to contend with. But thus it is; in addition to the railways costing the country 3,000,000*l.* a year for interest of debt, &c., above what they yield, they are at this moment the one obstacle to India being supplied with the very first requisite of all material progress, cheap and sufficient traffic. There is no possible answer to Mr. Leslie's Paper. It puts in an indisputable light the whole question of material improvement. In Canada we have set an example of cheap transit, which the States now see that they must follow or be beaten, and they are planning a vast system of water-transit. France is making a water-line from Havre to Marseilles at a cost of eight millions sterling, to carry vessels of 350 tons by the side of a railway that has been tried for forty years, because the railway cannot carry the quantity or at the charge that is essential. Why should not we take warning at once before India loses another hundred or two of millions, and set about to give her this inestimable boon? We know now that railways cannot carry the quantities required nor cheaply, that they cannot prevent millions dying of famine, &c. What strange obstinacy it will be if we still persist in this ruinous course with our eyes open.

Chairman.

2211. You would like, would you not, to add some general conclusions?—Yes; first, the very first work is to connect the present patches of navigation with each other. It is impossible to estimate the return that these works will make. Links of 50 or 100 miles will give effect to hundreds of miles now in operation, but comparatively useless from their being isolated; for instance, the Ganges valley line; that of the Orissa Delta; the Toombudra and Madras line; the Upper Godavery and Madras line; the West coast, where the petty native States have shamed us by cutting their part, while we have not had enough energy to do ours. For instance, the fifty miles from Allahabad to the Soane canals, would open the line from Loodiana to the Lower Ganges; eighty miles in Cattach would increase the value of every acre in the vast Delta of the Mahanuddee, and so on. I am certain no money could now be laid out in India that would produce such great results as this. The second work is to restore and supply the old tanks. The third is to carry out the main lines of navigation. The fourth is to execute irrigation works in every district of India, not omitting one according to its peculiar circumstances. I am quite certain that if these works are energetically carried out by men heartily forwarding them, not by men secretly endeavouring to their utmost to prevent their producing their legitimate effects, they will not only almost completely prevent famine, but add hundreds of millions per annum, I speak advisedly when I say hundreds of millions, to the value of Indian produce. The annual produce of Godavery has certainly been increased by more than two millions a year, and it is only one of 150 districts, and it is still isolated and not ineffective communication with all the rest of India. I grant that the up-land tracts will cost more to irrigate and open than Godavery, and therefore that the return will not be 200 per cent. in them, but this is not necessary. But the links of canal will probably quite equal this. Mr. Leslie shows that two millions spent on his link will return 100 per cent. by the present traffic, saving two millions by the expenditure of two millions, but how much more will it yield when it forms part of an effective communication to Loodiana. Nobody who has not really looked into this matter can form any idea of the wonderful results to which this transit question brings us. If a link of 50 miles leads to the carriage of a million tons over 500 miles, with a saving of only a penny a ton, it will save two millions a year, the link costing 200,000*l.* If it is asked, but do you expect that the irrigation works will pay their interest? I answer first, that I am perfectly certain that they will do so in spite of all efforts to prevent it, although of course the means adopted with respect to the Orissa works may be so far successful as greatly to delay results. Certainly if works are dawdled over for twenty or thirty years, and then stopped before they are half finished, and if the management of them is so wretched that things are allowed that prevent men from taking what they are most intensely anxious to get, there may be any amount of waste; but I have that confidence in water that I am sure it will ultimately overcome all obstacles. And besides we are not to suppose that India is never again to have men who will know how to get over petty difficulties, and be really anxious to do so, instead of trying to make them. If the Orissa works are carried out to a moderate extent they will not certainly cost more than 3*l.* an

acre, and two and a half rupees water-rate will then be 8 per cent. gross, or 5 per cent. net. This is besides tolls. If the present canal ending at nothing, carries 150,000 tons, when the whole Delta is placed within reach of Calcutta, the traffic cannot be less than 500,000 tons, on which a farthing toll per ton for 250 miles would be 125,000*l.*, which alone would be 4 per cent. on three millions, watering a million acres. I am quite certain if this were done under a fairly able Governor of Bengal we should soon have a report of Orissa very similar to that of Godavery, and so with the Hooghly districts too. Only think of seeing the Province of Bengal raised out of its present terrible state of poverty, degradation, fever and hopelessness, and it could be reported of it that it was in as peaceful, contented and prosperous a state as any part of Her Imperial Majesty's dominions. What India wants I am fully persuaded is, that at least three lacks should be spent in every district on an average per annum on irrigation, besides carrying out a complete system of navigation to the same extent of expenditure; together, ten millions a year; and I am sure if this were heartily and ably done we should see such a revolution as hardly any country ever underwent. If report speaks truly, two of the provinces of India are already under a more vigorous system of irrigation management, and I trust that the two present Committees will lead to the turning over a new leaf. I have a good hope that as soon as England has got over the present political crisis, it will take up the matter of India, and no longer suffer famines to be trifled with, and millions left to perish for want of carrying out a perfectly well-known and proved remedy. Perhaps I may be allowed to read an extract from a letter which I got this morning from Godavery: "I wish you could see the noble and yearly increasing results of the works in this Delta." And from an Indian paper received to-day: "No one in Allahabad, not even the natives, have any idea that as near as Cawnpore hundreds were dying daily from starvation." This is the last news from India. "The constraint which" the writer of this letter from Bareilly "has put upon himself," is manifest in every line of it, and yet how terrible it is. Travelling in February, "I saw," he says, "men lying dead by the wayside; others abandoned to perish; scores were tumbled into old wells, the deaths being too numerous for the miserable relatives to perform the usual funeral rites. Scores of children were emaciated to the last degree. Here was a family of little children, both parents dead; there a widow with three small children; more than one hundred had perished already in this, not large, village. I applied to the Magistrate, and the prompt reply was, that there could be no departure from the established mode of relief." That is in *The Friend of India* of the 28th of May, and refers to the state of things in the North-West, Oudh and Rohilcund at this moment.

2212. Does that conclude the statement which you wish to put in before the Committee?—Not quite. My second answer to these questions is, what I especially insist upon, that we must not let this secondary point, material as it is, hide from us the great primary one. We have abundant proof that we can go on watering India at a cost of 2*l.* 10*s.* an acre, and we have certain proof that irrigation will increase produce by from 1*l.* to 2*l.* an acre, which is from 40 to 80 per cent., an average of 60, and we are also assured by actual results that the remaining pecuniary benefits from cheap transit for any quantities to every man's door, draining the land, &c., are far beyond another 40 per cent.;

so that an average of 100 per cent. in money returns is abundantly proved by actual results on a vast scale; and all this is besides the first point of all, which is security from famine, instead of the millions which the railways have left to perish wherever they have been tried; every day the accounts are more and more terrible of the loss of life in districts in which this miserable expedient has been tried at the rate of a million pounds per district. But we know these things, that a steam-boat canal can be made cheaper than a railway; that it can carry cheaper; that it can carry all that is wanted, and that a railway cannot; and that it can carry at ample speed for every purpose; that in case of disturbance it is incomparably more defensible; and that it can be, in most cases, combined with irrigation and drainage; and the supply of good wholesome drinking water will always accompany it. I ask then, what is the reason for persisting in railways; we are rational beings; do let us have some reasons for what we are doing. The adversaries of irrigation cannot show one thing in which railways will have the advantage over steam-boat canals in India, and the chief Railway Engineer insists upon the necessity of cutting a canal by the side of a railway that has been tried for twelve years, and gives plain figures that nobody can set aside. This is a great question; it is impossible to overestimate the terrible responsibility that rests on this Committee. Their decision cannot but affect most seriously a rapidly increasing population now amounting to 240,000,000; and not only so, but also the character and well-being of this whole vast empire, for our own well-being is now inseparably connected with that of India. I must myself do my utmost to help them to come to a sound judgment, and I do not see how I can do that without some reference to myself. I never made this a personal matter, and I trust I am not going to begin in my old age. I never asked for an appointment, or for anything else, except to be allowed to irrigate India. I never possessed property, nor ever took a share in any speculation, that I might have nothing to occupy my thoughts or warp my judgment, but might give myself up to my duty of helping to raise India in this particular point. It has pleased God so to prosper the works that I have been engaged in, that the dispute among my adversaries is whether returns are 17, 28 or 40 per cent., and in another, whether the return is not less than 87 per cent. Now may it not help the Committee to understand this question, if they will consider what must be the weakness of that side in a cause, when the opponent is held up in a place where he could not answer for himself, as the wildest and rashest of Engineers, and before this Committee, after fifty-seven years' acquaintance with the business, after having had a hand in irrigating millions of acres, and cutting thousands of miles of canals, as a man who was so profoundly ignorant of his profession that he did not know where a canal could be cut, and where it could not, nor even after having traversed almost all India, with one thing in view, did not know where there were mountains, and where there were not. In setting about to judge between myself and my opponents, or rather between the views of myself and those of my opponents, may it not justly be considered whether a man who has certainly been the most successful and has had by far the longest experience, knows something about what he is talking about; and then cannot wise men judge of the plain facts and figures which he has set before them in this evidence. How is it possible to get rid of these facts? Are Tanjore, Kistna and Goda-

very at this moment strewed with hundreds of thousands of the skeletons of victims of famine? Are the districts of Bengal and Madras on which millions have been spent on railways, rolling in health and wealth and plenty, in freedom from fever and death? Has the Revenue of Bengal, have the Revenues of the railway districts of Madras being raised by an addition of 150 per cent? Did any railway ever raise a crop of human food worth a million of money in the midst of the famine as the Madras Company's Irrigation Works did, saving Government 500,000*l.* in their famine expenditure? Can any sophistry in the world or any contempt of one who brings forward these facts, get rid of the facts themselves. Supposing these facts were brought forward by a man who after fifty-seven years' practical experience did not know how to cut a canal, or where one could be cut, how would that alter the matter?

2213. You have placed before the Committee very clearly your views, and you have stated that, speaking generally, you are in favour of a very large expenditure annually upon irrigation and navigation, and you propose that a sum of 10,000,000*l.* per annum should be appropriated to that purpose, and with reference to your estimate, we should gain on the expenditure?—I feel perfectly satisfied that it would return to the Government the interest of the money; of that I have not the smallest doubt. Of course each individual case will have to be considered and ascertained. May I just add one word to that; we are in this peculiar position now with respect to communications that we have got thousands of miles of effective navigation isolated, and not doing one-tenth part of the work that they would do, but for the want of a little bit to connect them. We are in this position that fifty miles here and eighty miles there, and hundred miles in another place, would give effect to thousands of miles of navigation, and in that way Capital so expended must of necessity produce such immense advantages.

2214. You have given us very full and interesting information concerning the returns of certain works in the Delta of Madras, namely, in the Delta of the Cauvery, Kistna and the Godavery; I will assume for the moment that all your figures in connection with these works are correct; what other irrigation works in India, which have been constructed during the last twenty years by the Indian Government, now pay, excluding those in these three Deltas?—None of the great works pay yet.

2215. Therefore, is it not pretty clear that a great success may have been attained in a certain part of India, that is in the Delta of Madras, but that a similar success has not yet been attained by the works in other parts of India?—I have given the reasons for several of those.

2216. Therefore it would not be safe, from your experience, or the experience of anyone else in these three particular districts, to generalise for the whole of India?—No; I only take encouragement from them; each individual scheme must be examined on its own grounds, of course.

2217. We have had very able and clear evidence from the officers of the Public Works Department; I do not know if you have looked through the papers which they have handed in, and whether you have seen the forecast of expenditure?—Yes, I saw that forecast.

2218. Did you there notice that the Public Works officers, whose business it is to push on irrigation as much as they can, estimate that although year by year an additional sum of say a million or more is to be applied to irrigation,

yet year by year the return is worse?—I do not know how they make that out.

2219. But it is a fact that in that estimate they do allow for a worse return some four or five years hence than what they estimate now?—I am aware of that.

2220. If by a moderate expenditure of one million per annum, we are five years hence to have a worse return than we have now, it is quite clear, is it not, that if we spend ten millions as you propose, we should have ten times as bad a return?—I am quite certain that that is not a correct view of the case.

2221. Then you must utterly dispute the figures of the estimate of the Public Works officers?—I give figures here of the general results, and the probable cost of works from the actual cost of works that have been executed, and that you can irrigate at 2*l.* 10*s.* an acre; there is no dispute about it, nor can there be any, and that two and a half rupees an acre, that is 5*s.* on 2*l.* 10*s.*, is ten per cent.; there can be no dispute about that.

2222. But your figures I think you derive from your experience in Madras?—From the whole cost of the works all over India.

2223. That is by lumping them altogether you make the profit on the works that do pay go to compensate the loss on those that do not?—No; I am speaking now on the conclusions which we draw from what they have cost. The estimate now for the Soane work is 2*l.* 10*s.* an acre, the ultimate cost of getting the water, and two and a half rupees water-rate would be 10 per cent.

2224. But they have not realised that; that is what they hope to get?—There is no reason why they should not. They watered 270,000 acres this year by the Soane, and there is no reason why they should not at all.

2225. Still, as you admitted in your first answer, with the exception of the works in the Deltas of Madras, there is scarcely a large irrigation work which has been carried out by the Government during the last twenty years which does pay?—No, not at present.

2226. Therefore, although it may ultimately pay, yet at present our experience is, that the sanguine anticipations concerning irrigation have not been realised?—Yes; neither have you got any returns from the Godavery navigation; a work estimated twenty-five years ago is put off, stopped, gone on with, stopped again, and gone on with again for twenty-five years, until the value of money has altered three-fold, and then just at the last moment when it is entering the populous country, it is put a stop to altogether, and you say that the Engineer is at fault, that his estimates have failed, and his works have failed, and of course what can stand against that.

2227. Take that particular work, do you know why it was stopped?—I am sure I do not know why, except that I know that it was a sort of antagonistic work to the railways.

2228. The reason of it was that an elaborate Report was made on it, and the first Commissioner of the Central Provinces, Mr. Morris, and several other persons, expressed their opinion that that work never could pay, and the Indian Government, at the time when, I think, General Strachey was the head of the department, sent home a despatch, which concludes in the following words: "The project has already swallowed up 700,000*l.* with no practical result, in obtaining a through communication. The work cannot be utilized

in any sensible degree until a total outlay of at least 900,000*l.* has been incurred, and cannot be made complete for navigation under a total outlay of 1,200,000*l.* The history of this project should, we think, be a caution to every future Government of India not to take up engineering projects, until complete designs for the works and estimates of their cost have been carefully worked out." That was the ground for refusing to go on with the work?—What conceivable object could there be not to make that work for 3,000*l.* a mile, by their own statement, 400 miles for 1,200,000*l.*, when they had got branch railways in that very district at 9,000*l.* per mile, three times the cost. This thing cannot be answered. They most solemnly and seriously object to spend 3,000*l.* a mile on a grand main line of communications of 400 miles, at the very time that they are spending 9,000*l.* a mile in little branch railways merely to carry the coal on that very spot.

2229. Do you not think that they probably spent the money on railroads because they thought they would get some advantage from the expenditure, and that they did not do so on the Godavery, because there seemed to be no prospect of their getting any return?—There was an absolute certainty that the Godavery works would be used to a great extent; there was no possible room for doubting it.

2230. Did you never hear the fear expressed that during four months in the year there would not be sufficient water for navigation?—Yes.

2231. And those are the four months during which the traffic would be most anxious to utilize the canal?—My answer to that I have given already; that if you wanted to complete the navigation for the whole year, you could do that at a very moderate expense by storing the water.

2232. That is an expense additional to completing the canal, and not included in the 150,000*l.*?—That is for making it for the whole year.

2233. Although to you the Indian Government may seem to be very unreasonable, it is possible, is it not, that they may have had good grounds for not going on?—But they had no grounds whatever; that is what I insist upon, and am prepared to prove; that it could not be right to spend 9,000*l.* a mile just upon little branch railways, when you would not spend 3,000*l.* a mile for water. Nobody can answer that.

2234. What was the railroad upon which they spent this money?—Those three railways in Nagpore; the two branch railways in Berar, and one in Nagpore itself, down to the railway, they are spending 500,000*l.* on 60 miles of railway.

2235. That money was spent, was it not, in order to get to the colliery?—Then why may not I say that the opening of the Godavery was to carry that very Wurda coal down to the port, and make Coconada a coaling port?

2236. But unfortunately the canal would not have been navigable at the very time that it would have been wanted?—In the first place you are not obliged to carry coal at any particular time; it is quite a mistake to suppose that a line of transit is of no value that is not open for the whole year round. The Erie canal is only open seven months in the year, and it is the great artery of the United States.

2237. Supposing that the coal had been carried from Warora to Coconada, who would have wanted it?—Coconada would have become immediately a

coaling port, and ships would have called in there on their way to Calcutta and back to take in coal.

2238. But coal was wanted West, was it not, and not East?—It was wanted in both places; in Madras it is continually wanted; Coconada and Madras would both have become coaling ports.

2239. But the connection of the railway with this particular colliery, enables the coal, does it not, to be taken both to Bombay and to Madras?—No, it makes it perfectly impossible, because it is at an impracticable cost.

2240. There is a very large coal field near Calcutta at Raneegunge, is there not?—Yes.

2241. Is it not more likely that if Madras wanted coal, the coal would come from there than from this inland colliery?—They could not bring it as cheaply.

2242. Why not?—Because the inland canal and river navigation would be cheaper than bringing it from the port of Calcutta, having to go out to sea; and owing to the enormous demands of inland short distance transit, compared with the sea transit.

2243. Why would it be cheaper?—The inland service is so exceedingly cheap, as I have stated.

2244. That is to say, if you charge no tolls on the canal?—You may charge what tolls are necessary, but I am including tolls, if you choose to charge them.

2245. Surely the cost of transit would depend entirely upon what you charged?—Of course.

2246. And the amount to be charged would, I suppose, depend very much upon the cost of the canal?—Yes.

2247. Therefore it comes to this, that unless the canal can be made for the figures that you estimate, the cost of transit would be greater than what you contemplate?—I take the figures which you yourself have given me, upon which the cost of the navigation of the Godavery is 3,000*l.* a mile.

2248. But you arrive at those figures by taking the total length of the river which becomes navigable, and you put that total length against the cost of the two or three canals which are made to get round the impediments in the Godavery?—I take the whole line, and it comes to 3,000*l.* per mile, according to that estimate.

2249. That is, you can make the river navigable for a certain distance for 3,000*l.* a mile; but it does not follow that you could construct a navigable canal for 3,000*l.* a mile?—I am not speaking about the canal now. We are talking about the navigation of the Godavery. As respects the cost of the canal when it gets down the Rajahmundry, the next ninety miles of canal has cost 1,000*l.* per mile.

2250. In your evidence you stated that the canals had been constructed at a cost of from, as I understand, 1,000*l.* to 6,000*l.* a mile?—Yes; those are the extremes. Some canals have cost less than 1,000*l.* a mile; but I am speaking of a large canal.

2251. That is a canal which is navigable?—Yes.

2252. What canals have been made at that cost?—The Kistna and the Godavery canal of ninety miles cost 1,000*l.* a mile, right across the lay of the country.

2253. Excluding those canals made in the Delta, what other canals have been constructed ?—This is not in the Delta. It is out of the Delta. It is across the lay of the country, in the upper country from Rajahmundry on the Godavery to Bezoarah on the Kistna.

2254. Can you give any other instances of canals which are navigable ?—I have not heard yet of any that have been opened. They have cut a canal from Madras to the North, I believe, now, to Nelloor. I saw a private letter saying that they hoped it would be opened all the way to Kistna, and to the Godavery, by last Michaelmas ; but I have never heard of its being done so. If it is, it has cost much less than 1,000*l.* a mile.

2255. Is there a single canal which is navigable with the exception of those in the Delta of Madras which gives any return on the navigation ?—I do not know what are the returns on the Ganges canal navigation ; I have not seen them for a long time.

2256. Is it not a fact that, with the single exception of those three canals, there is no return on the navigation canals throughout the rest of India ?—There are very fair returns now for a beginning on the Midnapore canal, and on the Hidgly canal.

2257. Are you aware that the Indian Government, in a resolution which was published some four years ago, came to the conclusion that the increased cost of making an irrigation canal navigable, and the small return which they derived from this increased cost was such as to make it in many cases quite impracticable ?—I say it is directly contrary to the fact.

2258. You admit that there is not a single navigable canal that has paid except those three ;—The Ganges canal was brought to Cawnpore, and had six essential defects in it, and the locks connecting it with the river, were not allowed to be used. The Orissa canal was carried sixty miles from Calcutta, and ended in the middle of the Delta. Supposing they had done that with the railways. What in the world had those got to do with the actual returns of the canals; and this canal carried from Calcutta and ending at nothing, not even in a great town in the heart of the Delta, is now actually yielding 3½ per cent., and increasing most rapidly.

Sir George Campbell.

2259. On what Capital ?—On 6,000*l.* a mile.

2260. Are you aware that the Hidgly is a tidal canal in low land ?—Yes. It costs 6,000*l.* a mile, and it is returning 3½ per cent., though it ends at nothing.

Chairman.

2261. There may, therefore, be canals which, under favourable conditions, will give a certain return, but the general result of our experience of the last twenty years is, that navigable canals throughout India have not paid ?—My reasons which I give for that are quite sufficient. If the railways had been carried 100 miles here and fifty miles there, stopped in the middle and ended at nothing, and kept hanging on for twenty years, what would have been the result ? Supposing there was a railway 100 miles out of Benares, ending at nothing, people would have turned round to the Railway Engineers and said, "Look at the result of your work. Millions and millions have been spent upon them, and no hesitation upon the question whatever, any amount

of millions have been spent upon them, and we ask for 100,000*l.* or 500,000*l.* to complete a line of canal, and it is refused."

2262. Cannot you give any reason for the Indian Government being anxious to prosecute railways?—I know the reason perfectly well, but I cannot give it.

2263. Why not?—It would not be respectful, but I know perfectly well what it is. They have not done it; there is the fact; there is no denying that.

2264. I suppose the reason is, to use your own words, the dread of the officials of cheap transit?—Yes; that is the horror of the whole official circle now.

2265. Do you really mean to say that you think that for the last twenty years every Viceroy and every official connected with the Public Works Department and the Council of India, generally, and all the Secretaries of State have been actuated by, as you put it, the dread of cheap transit?—Yes; I only say what are facts; I need not say anything. I say, is the canal from Calcutta to Cuttack finished; is the link connecting the Lower Ganges canal and the Soane cut; is the Ganges canal put in an efficient state of working or not; are the boats permitted to go through the locks into the Ganges or not?—It is not what I say. These are facts.

Mr. Sampson Lloyd.

2266. What is the dread of cheap transit; is it lest it should affect the traffic on the railways?—It is not what I say; this is Mr. Leslie's statement, the head Railway Engineer.

Sir George Campbell.

2267. Does Mr. Leslie say that the Government officials dread cheap transit?—No; what he says is, about the cheap transit that there would be over the canal.

2268. The question is, why the Government official should dread cheap transit?—I only state facts.

Mr. Sampson Lloyd.

2269. But there is a motive attributed to the Government in saying that they dread cheap transit, and I want to know what is in your mind, why any man should dread cheap transit?—Because it would stultify the railways, that is the sole point; only think of a canal by the side of the Eastern Bengal Railway, which carries some 200,000 tons, and a canal by the side of it carrying 2,000,000 tons, and swarming with passengers and goods, and boats; what a terrible affront to the railway that must be.

Chairman.

2270. Therefore you think it is with a view of protecting the railways that the Indian Government will not spend more money on navigation?—There has been that bias (no doubt they were not aware of it themselves) continually acting against effecting cheap transit.

2271. You think that they are still actuated by this secret bias, although from the figures that I have shown you it is clear that the returns from canals every year are less the more you spend on them, and that exactly the reverse is the case with regard to railways?—That is exactly contrary to what I say; I say the more you spend on them the better will be the return. If you spent 500,000*l.* on that remaining eighty miles length of the Cuttack canal, the

canal would pay an enormous interest if you choose to take toll at this moment.

2272. You have expressed a very strong opinion that it is in consequence of the non-completion of those works they do not pay?—Yes.

2273. Do you remember the report which you wrote on the project of the Madras Irrigation Company?—Yes.

2274. And do you recollect that you advocated it very strongly, and one of the main reasons which you gave was "That one great advantage of this system of works is that it is composed of parts, each forming a complete system in itself, and which as soon as completed will yield its own returns independent of the remaining parts; it must not be supposed that I recommend that one part should not be begun till another is finished; on the contrary, I would undoubtedly commence at once upon every part of the works comprehended in the whole scheme of 2,000,000*l.* I merely mean to point out that we shall not have to wait for returns till the whole scheme is completed, as if we were building a bridge, but that as soon as one part is executed, it will at once come into effective operation and yield returns;" that prediction has not been altogether realised?—No, the water has been refused. That is another element also which, of course, I did not contemplate. I had been fifty years in the country and never heard in my life or dreamt of the water being refused by anybody in the district. No such thing had ever been thought or heard of that there could have been such inconceivable blundering and mismanagement as that the poor people could not take the one thing of all others in the world that they desired, water. Of course it never entered my head. I could not have put such a thing in the project, but if there is such inconceivable mismanagement that the poor people cannot take the water which they want above everything in the world, and that the works would not pay, I could not add that to my report.

2275. Still, from some unforeseen circumstances your prediction has not been realised?—Not from any defects in the works, but from a defect in the management. I am a manufacturer, and I make a locomotive, and I say, "Here is a splendid locomotive," and it is taken to the railway, and it bursts because the man is drunk who works it; am I answerable for that?

Mr. Onslow.

2276. Will you explain what is the defect in the management to which you allude?—If I were to go and formally look into it, I could no doubt give the particulars of it; but here, as the Governor has himself acknowledged, the Company have been unfairly dealt with, and they have brought in a new element altogether; a man specially appointed to try and put things to rights. That is a complete acknowledgment of the mistakes that have been made, and that is from the Governor's own minute.

Chairman.

2277. Whose minute was that?—The Duke of Buckingham's minute which has just been reported.

2278. In that minute he admits, does he, that the non-productiveness of the canal is entirely due to the Government?—He does not say that it is entirely due to the Government, but "the matter was referred by the Government to its Board of Revenue, who reported in August 1877 that 'nothing short of the appointment of a special officer will suffice to put the affairs of the

Company in their relations with the Madras Government on a right footing,' and 'recommended that an officer of a Sub-Collector's standing should be appointed to have charge of the villages irrigated by the canal under the orders of the Collectors of Kurnool and Cuddapah, through which districts the canal runs;' at the same time expressing their belief that such an officer 'would probably be able to set things straight in a couple of years or so.'" Then the Government minute upon that is, "From the papers entered above it is clear that no other arrangement will meet the difficulty. It has been decided in the Public Works Department that the appointment of a covenanted officer of some standing should be recommended. It is pointed out in the memorandum of the Chief Engineer for Irrigation, that the Company have real cause of complaint; that practically their officers have been doing work which should have fallen upon the Revenue establishments, and that Government are under an obligation to set matters on a proper footing without further delay. It is recognised that the ordinary district administration is not strong enough to devote sufficient time to this branch of their duties, and it is undoubtedly the case that the work involved by the formation of the canal is increasing in quantity and importance every season." "The Collector of Kurnool, who had been called upon for information on the alleged action of his Deputy (who besides other duties had the management of the settlement and accounts relating to irrigation under the canal), in issuing orders practically preventing applications for water being made, as heretofore, by the ryots to the Irrigation Company's officers direct, reports that the manager of the Company had certainly cause for complaint, in consequence of the wording of the vernacular instructions issued by the Deputy Collector, and that generally he is not satisfied with the way in which that officer's duties have been performed." An Engineer wrote that he remonstrated with one of the landowners, saying, "Do not you acknowledge that there is a great increase of crop from the water?"—"Yes, certainly." "Then why do not you take it?"—"I cannot stand the persecution that it would bring upon me from the native officers of the Government." And so in Orissa it is just the same. A man said, and many men said, "What is the use of my taking the water; half of the profits will go to the Soukar, and half to the Zemindar; I shall be no better off."

2279. But the system of land-revenue is entirely different, is it not, in Orissa to what it is in Madras?—Yes; I only mentioned what they said.

2280. Therefore we have those two remarkable facts, that in two different parts of India, under two different land settlements, the irrigation works have proved, up to now, complete failures, because the people will not take the water?—Yes, because the water has been refused by the people.

2281. You never anticipated, as you admit very candidly, any such result when you advocated them?—No; there had always been such good management up to that time, that I never thought such mistakes could possibly be made.

2282. Are you aware of the present financial condition of the Madras Irrigation Company?—Yes.

2283. A Capital of 1,000,000*l*. was raised, upon which a guarantee of 5 per cent. was given by the Government; this was expended, and a loan of 600,000*l*. was advanced by the Government to the Company; no interest has

been received on that loan, and only a part of the loan has been repaid by heavily mortgaging the work itself; is not that the state of things?—Yes.

2284. So that up to the present moment, or until within the last year, the Government have had to pay interest on the whole of the guaranteed Capital, and have lost the interest on the whole of the loan advanced?—Yes, just as they have done on so many railways.

2285. And also they have had to make good the working expenses?—No; the last two years the returns have exceeded the working expenses.

2286. That is the result of the Madras Irrigation Company; I merely wish now, such being the result, to contrast it with your anticipations in this Report; will you just listen to these words? You say, in answer to the objection, "When we have secured our plunder, it will be a very agreeable task to sit down at our leisure and divide the spoil, but discussions about it before we have it not only prevent our getting it, but cause unpleasant differences. It is the actual possession that puts everyone in good humour with himself, and even his opponents. To be convinced of this it is only necessary to read the account of the discussions at a half-yearly meeting, where there is a dividend of 80 per cent., as in the case of the Ganges Navigation Company;" it seems to me that you have repeated before this Committee, unchanged by experience, every opinion that you here expressed?—Precisely. Every single thing that has happened has entirely confirmed it. We cannot possibly mistake about the average cost of irrigation; we cannot possibly mistake about the profits from it, and the increase of produce; there can be no mistake about that. We know that in two cases there has been mismanagement of the works, and that the water has not been used. That is quite a separate thing, which has nothing on earth to do with the works themselves; it is quite a special thing. The Soane works are now in operation, and 270,000 acres are irrigated this year.

2287. Then supposing we were, on your recommendation, to spend 10,000,000*l.* a year, as the Government allowed this Company to be formed upon your recommendation, we might possibly find ourselves in exactly the same position as regards those 10,000,000*l.* annually as the Government now find themselves as regards the Madras Irrigation Company?—No; in the first part of my answer, I say I cannot conceive that, with all this experience which you have had in Orissa and the Toombudra, you would repeat the same mistake, and keep matters in such a condition that the people cannot use the water.

2288. But the Government might reply that they will not repeat the mistakes, because they will not make canals or irrigation works of which the people will not avail themselves?—The people will certainly avail themselves of the water wherever it is put into their power to possess it.

Mr. Sampson Lloyd.

2289. I do not clearly understand what you mean by the mismanagement which caused the people to refuse the water. Of course, if it is the people's fault, we may presume that it is possible at least that the people might be equally obstinate with the future expenditure which you recommend, but if it is the Government's fault, will you kindly define, in some degree, what sort of mismanagement it was which caused the people to refuse the water, and thereby caused your prediction not to be fulfilled?—Why should I do that,

when the Governor of Madras himself has done it for me, in what I have read. He states that the Company have not been fairly dealt with, and now we must begin upon a more sensible plan, and he appoints an officer to do it.

2290. Has the mismanagement been in the distribution of the water, or in what particular?—You cannot conceive the opposition that there has been to the use of the water on the part of the native officials, who have set themselves with all their might against the people using it.

2291. Then the people who are to blame are the native officials, and neither the Government nor the ryots?—The European officials did not take care that there was a different state of things, by over-ruling it, and putting a stop to it.

2292. Then we understand that you attribute the failure of the scheme of the Madras Irrigation Company to the misconduct of the native officials chiefly?—Primarily to them, and next to the European officials in not putting it down.

2293. Have you any idea what interest the native officials can have in behaving in this way?—They do not like the trouble of it, that is one thing. It is very difficult to explain all these things to a person who has not been in India, but when first we began the works in Godavery, there was an enormous increase of Revenue from the irrigation, and the native Sheristadar and the people said, "What clever fellows we are; look at the enormous increase of Revenue there is," and the Government replied, "Yes, the Engineers certainly have accomplished a great deal." Then they said, "If the Engineers are to get the credit of it, all we shall do is to prevent the water being assessed wherever we can. All our friends are the owners of land, and all we shall do will be to find excuses for not levying the water-rate." And they have actually done so. I suppose there are, at least, 100,000 acres in Godavery that have the full benefit of the water, but do not pay a farthing.

2294. Has no one ever taken the trouble to represent the misconduct of those native officials to those officials above them?—I do not know; I dare say they have.

2295. One would think, if it was notoriously the fact, as you believe it was, that somebody or other would have been zealous enough to speak of this misconduct?—I dare say they have, but I do not know the whole history of the transaction; but what I say is this; here was an individual isolated case. If a report appeared in the *Times* that one per cent. of the passengers on a certain railway in England had died, everybody would understand at once that there had been some egregious mistake. Here is Hooghly, the very district of Bengal, where water is the one thing that they demand and entreat, and here in this one isolated case, the water has been refused.

2296. May I ask you whether the Madras Irrigation canal is of any use as regards transit?—There was an exactly similar case. It is 190 miles of splendid navigation; and then it is cut off by eighty miles from the North Coast canal, so that it is comparatively useless.

2297. Do you attribute this want of success as a means of transit to the want of completion of the connecting link?—Yes.

Sir George Campbell.

2298. Is there any profitable or successful traffic on those 190 miles?—No, they are only just now putting it on a good footing. They have just got per-

mission to do it; the want of Capital has starved the navigation, but they are just now building boats for it.

Chairman.

2299. You spoke of the sum which this canal saved the Government during the recent famine, and which you estimated at 500,000*l.* The canal, as you are aware, costs the Government, adding compound interest, between 3,000,000*l.* and 4,000,000*l.*?—I am not aware of that. It could not have cost that.

2300. How much less do you estimate?—I could make out an estimate in ten minutes, but I have never made out exactly what it all comes to.

2301. If you have never made it out, why do you demur to my statement?—There has been only a million and a half spent, and it could not have been doubled. To double it, would require fourteen years' working, at 5 per cent.

2302. Has not the Capital been guaranteed twenty years?—No, it was only begun. All the Capital had not been expended, I should think on an average, perhaps, more than eight years.

2303. You are aware that a loan of 600,000*l.* was granted them twelve years ago?—I forget when the works were begun. However, it is certainly not fourteen years of full work.

2304. Still the loss is very large?—Yes.

2305. You remember, however, that this work was one which above all others you recommended?—Yes; and it is one of the most complete and successful works, if the water was used, that could be constructed in India. It carries water for 800,000 acres at this moment, 600,000 acres of dry cultivation, and 200,000 acres of wet; and the average increase would be 2*l.* an acre. That is exactly what I suggested.

2306. And it passed right through the famine districts?—Yes.

2307. Therefore, if people are ever likely to take the water, I suppose they would do so now, having had experience of the famine?—I hope so, if the Government put the thing on a sound footing; not without.

2308. Now I go to another work, the Orissa work; are you disappointed in the result of that work?—I am disappointed in the cost of the works. They cost more than I expected; but there is ample room for an abundant return even for the present cost.

2309. That is not the impression of the Government of India?—I am quite satisfied myself. There is no answering those things. As it is at present it has cost about 3*l.* 10*s.* an acre for those great headworks, with a small area of irrigation, but if the distribution was carried over all the Delta, the cost would certainly not exceed 3*l.* an acre, and two and a half rupees would be 8 per cent. upon that, besides any toll.

2310. What you mean to say is, if the work is fully utilised, that is to say, if the water is taken and the full area which can be irrigated is cultivated, and abundant use is made of the navigation of the canal, that then a certain return will be obtained?—A great deal more than the Government interest could be obtained.

2311. But it is only under those circumstances?—Of course, I suppose that the works are carried out. I put the project before the Government, and they say, "Yes, we will do the expensive part; we will delay this for years and years, and add all sorts of expenses and interest to it, and then we will leave out the principal part of the work, and we will turn round to you and say,

'You are a pretty Engineer.'" That is the history of the Orissa work, and the Godavery Navigation works, and of all these works.

2312. Do you recollect that when you sent in your report concerning the Orissa work, you ridiculed, in very strong language, the absurdity of constructing railways in Bengal ?—Yes, I daresay I did.

2313. Are you aware that those two railroads which you thought would be so useless, paid last year between 9 and 10 per cent. ?—I daresay they did.

2314. Then it seems now from our experience that you were wrong in your prediction ?—No, I was quite right; and I call Mr. Leslie, the Chief Railway Engineer, to witness.

2315. How can you be right when you say that it is an absolute failure if it paid 10 per cent. ?—I say it does not carry the quantity, and it does not carry so cheaply as the country requires, that I call a failure. When the Chief Railway Engineer himself says, "Here is a railway which leaves nine-tenths of the passengers and goods behind"; if that is not a failure, what in the world is ?

2316. But if it pays 9 or 10 per cent., and only carries one-tenth of the traffic, it is so far as it goes a success, is it not ?—No; it is a failure as respects the State; it does not carry the goods that are wanted to be carried.

2317. If it is remunerative, and the Government undertook it on the ground that they would get a certain return from it, surely it is a success ? —Because they took an entirely wrong view of the subject. They were seeing whether they were to get 5, or 6, or 9 per cent. for their money, instead of whether it would do the work that there was to be done.

2318. If we apply the same test to this canal in Orissa which you apply to the railroad, the canal is an absolute and complete failure, is it not, because it has not done the whole of the work which you think it ought to do ?—Because it is not carried out; that is all; nothing else in the world. I did not say that if you carried the canal from Calcutta half way to the Ganges and then stopped, that it would then have paid 10 per cent.

2319. Possibly when the line was commenced it showed signs of a return which induced the Government to complete it ?—There was no sign of it for years and years. It is in debt now, and it has not paid the interest upon its debt now; it is not solvent. The East India Railway is the only railway in India that is solvent at this moment, that is to say, it pays the interest of its whole cost and debt; that is the only one. There is fifty millions of debt on the railways at this moment.

2320. That is calculating the arrears of the guaranteed interest ?—Yes. How can this be answered ? Works that do not pay their interest of cost and debt, that do not carry the traffic of the country, and that charge a rate which does not answer the purpose of the country; how in the world can those be said to be a success ?

2321. I do not see the difference between those works and the two works which you recommended in those particulars, because those two Companies, the Madras Irrigation Company and the Orissa Canal Company, have failed more completely than the railroads to do the works which you estimated they would do, and they have in addition been a heavy financial loss to the Government ?—Suppose the whole power of the Government had been laid to keep

back the railways and to help forward the irrigation work, what would have been the result then?

2322. But you assume that the whole power of the Government has been employed?—Yes, evidently, or else why are the works not carried out? There is no answering that. Here is the fact, that the main canal from Calcutta to Cuttack is not finished to this day. There is no getting rid of that fact. The Upper Godavery Navigation works which were projected in 1853 are not complete now, twenty-five years afterwards. There is no getting over those facts.

2323. It may not be completed, because the Government did not see the utility?—Because they would not give the money to complete it.

2324. And you think that they sanctioned this work and this expenditure with the deliberate intention of leaving it unfinished?—How can you account for it; there is the fact that they are unfinished to this day.

2325. Are you really serious in stating before this Committee that you believe that successive Governors-General have given their sanction to the construction of certain irrigation works with the deliberate intention of leaving them incomplete in order to protect the railroads?—I only mention facts; what on earth is the use of arguing against facts? Here is the Godavery Navigation after twenty-five years not completed. Here is the Cuttack canal not completed. Here is the distribution of water in Orissa not completed. That is no opinion; they are facts. The railway from Calcutta to Benares is finished; there is everything finished in connection with the railways whatever it costs.

2326. The reason seems to me obvious that the Government tried the experiment of making railroads and irrigation works, and navigation canals, and found that the one answered and paid, whereas the other did not?—They did not find that the one answered; for in the case of every railway in India it was ten, or fifteen, or twenty years before they even paid interest on the cost, to say nothing of the debt. They went on in spite of there being no returns at all worth mentioning.

2327. You say that they do not pay, and that if you applied the same test to irrigation works which you do to railway works, they would be found to give a much better return?—Yes.

2328. As I understand your figures, without going very much into detail, you credit to irrigation the whole of the water-rate, and the whole of the increase of the land-revenue due to irrigation?—No, I do not add that. I only take the water-rent. I said that a great part of the increase of the general revenue is due to them, but I did not put it into my calculation.

2329. But the land-revenue you did?—No, only the water-rent.

2330. How do you get the increase in the Cauvery and the Godavery?—The case is as simple and as plain as words can be. Here are so many acres of unirrigated land, yielding a rupee and a half, and here are so many acres of irrigated land yielding five and a half rupees, as the effect of the irrigation. There is no difficulty about that whatever.

2331. That is to say, that the land-revenue derived from that area is increased by so much per acre?—Yes, four rupees an acre is the water-rate. The money that is due for water-rent is four rupees an acre in Tanjore.

2332. Is that the system throughout Madras?—Yes.

2333. In the North-West Provinces are you aware that there is another system?—Yes, there they charge two and a half rupees.

2334. Theirs is a system by which they pay a certain sum in water-rate, and there is also an indirect return to irrigation taken from the increased land-revenue?—I do not know why they do that. There is a great increase of land-revenue in Madras, but it is never charged to the irrigation account.

2335. If you look at the Public Works Accounts you will see credited to irrigation direct and indirect receipts, and the indirect receipts mean the enhanced value of the lands from the irrigation?—Yes.

2336. What indirect results do you credit to the railroads, because railroads increase the value of the lands through which they pass?—It is not perceptible. They may increase the value of a few acres of land just round the station perhaps. I do not know how that may be.

2337. Do you believe that the land in the immediate vicinity of the railroads that have been constructed throughout India has not increased in value? —No, I should think not perceptibly.

2338. Land in this country is more valuable in the immediate vicinity of railroads, is it not?—Yes.

2339. Why should the reverse hold good in India?—Only that it does not. There are abundant reasons for that.

2340. You have not been in India, have you, since the system of railroads has been completed?—No.

2341. Therefore in stating that the railways have not increased the value of land, you are not stating the opinion of any official who has recently come from India?—There are no indications of it, in any way that I know, showing that it has increased the value of land. The districts of Madras which the railways run through are all just in the same state that they were.

2342. When the Land Settlements fall in, do not you think that the land in the immediate vicinity of a railway station will be assessed higher than at present?—Perhaps a few acres just around a station may be.

2343. But it affords facilities for the transport of produce?—Yes, but at such a price that it can hardly be carried, and then only the small produce, not the great produce.

2344. Have you looked at the increase of the wheat traffic in the last few years?—Yes.

2345. Are you aware that nearly the whole of that increase has been carried by railroads, although the Ganges run side by side with the railroad?—Yes.

2346. How do you reconcile that fact with your statement that the cost of transit by railways is too expensive?—Because the river is nearly as expensive, including all its wandering course and all its drawbacks, insurance and everything, it is nearly as costly as the railway, but that has nothing to do with the steam-boat canal; it is very difficult transit on the river.

2347. I cannot understand how the transit by water can be as expensive when there are no tolls to pay, and there is nothing but the loss of time?— And the risk.

2348. If you had those canals with steamers going, as you propose, at the rate of fifteen miles an hour, there would be very serious risk on the canals, would there not?—I do not know why there should be. It often puzzled me

how the boats could live on the river. I was standing on the banks of the Ganges one day when one of those North-Westers came on, and out of a fleet of twenty-four boats in the stream, about twenty went down immediately.

2349. What time of the year was it?—It was during the time of the North-Westers, in April.

2350. At the time when there is a great export trade at Calcutta?—There was an immense traffic on the river, as there always is, in spite of those drawbacks.

2351. But still you cannot deny that the greater part of the wheat which has recently been exported from India, has been carried by rail, and not come by water?—I daresay it answers to bring it at a half-penny a ton a mile.

2352. Are you also aware that the officials of the Punjab and Scinde anticipate that when the Indus Valley Line is completed, there will be a great impetus given to the wheat trade in Bengal and the Punjab?—Yes, there will be some impetus in spite of all the drawbacks. I think if there had been a canal cut there, it would have given all that the North-West and all the Punjab required. The wheat carried between the North-West and Kurrachee would have been almost entirely annihilated, and the canal would have given new value to every atom of produce that they had. May I add that Mr. Robertson, the Superintendent of the Government Model Farm, was sent to report upon the state of Coimbatore, and this is one of the things he said, "The high price which the right of occupying this irrigated land commands (sometimes as high as 250 rupees per acre), convinced Mr. Robertson that the Government demand, ranging from nine rupees to thirteen per acre" (four times what they are taking in the North-West), "was not excessive." But they charge ten or eleven rupees an acre, and 1*l.* an acre, where they are selling land at 25*l.* an acre in Coimbatore, an out-of-the-way part of the country. That will give you some idea of the increase of value by irrigation.

2353. What was the canal from which they got their water?—One of the old native canals in Coimbatore. There is a great deal of old native canal-irrigation in Coimbatore; as much as 100,000 acres.

2354. You expressed doubts as to the harm done by that saline efflorescence called the *reh*, and you did so on the ground that you had never seen it; but you have not been in any part of India where that has broken out?—No.

2355. Never having had any particular experience of that part of India, you could hardly pit your opinion against that of officers who have seen it?—It is no opinion; I only speak of facts; it is an exceptional case. There are 20,000,000 acres of irrigated land in India. How much of that is covered with *reh*? Not a thousandth part.

2356. But in the statement which you have made you attached no importance to the outbreak of *reh*, because you said you had never seen it?—I did not attach no importance to it; I said it must be exceptional, because there are twenty million acres at this moment in India probably that are not suffering from it. I did not say that it was of no importance, but that it must be inquired into.

2357. You said that you had never seen it?—No; I only gave that as a proof that it cannot be a general thing there; and all the years I have been in India, and all the millions of acres of irrigated land that I have passed over, I never saw an instance of it.

2358. You could not have seen it, unless you had been in the North-West, or the Punjab, during the last twenty years, where it exists ?—Therefore it is an exceptional case.

2359. But it need not necessarily be exceptional; it is the result of a certain system of irrigation which was not in force when you were in India?—I only speak of the fact that a very small extent, comparatively, is stated to be affected by *reh*.

2360. It depends upon what you call small; it is a very considerable tract? —But it is a very small part of the whole.

2361. Have you read Colonel Fife's evidence?—Yes.

2362. Colonel Fife stated that the return on the irrigation works which have been constructed in Bombay was only half per cent?—Yes.

2363. You do not attribute this to any mismanagement of the Revenue itself, but simply to the fact that the people have not yet appreciated the benefits of irrigation; would you go on constructing works in such a case?—I say I would inquire into every individual case. That evidence of Colonel Fife is generally against irrigation in the Upper District of the Bombay Presidency; but I should go and inquire into each case, and see what can be made of it. If it cannot be done, of course I cannot help it; but each individual case must be inquired into.

2364. But I understand you to recommend as a *sine quâ non* that irrigation should be carried out in every district in India?—Yes, so far as circumstances permit it in every district.

2365. Therefore you would make this general recommendation subject to the particular conditions of each district?—Of course; but I may add this, that there are cases where I would not let its not being likely to pay 4 per cent. prevent its being done, because other circumstances may make it very urgently needful; a famine for instance.

2366. You are aware that no great irrigation work has been sanctioned by Government, except on the ground that it would be remunerative, and pay interest on the sum borrowed for its construction?—Yes.

2367. And it is only when the primary condition upon which this outlay was sanctioned has failed, that its advocates argue that it would be very useful to mitigate or avert famine?—But I do not admit that there is a single acre of India that would not be the better for irrigation, and that would not in itself pay amply for being irrigated. That is the point which I insist upon, that the increase of produce will abundantly pay for any expenses of irrigation; and it is a secondary question whether the Government can so manage that they can get a proper percentage for the Treasury. Before we leave this point, will you just allow me to read a few words from Colonel Haig about the refusal of the water, as we have touched upon that subject. It is with reference to the Hooghly district in Bengal, where the water has been refused. "There is not a single river, drainage, water-course, or channel of any description, large or small, in the whole district that is not bunded across at frequent intervals, from one end to the other, for the purpose of storing the water; not a pool, puddle, or water-hole, the right to which is not most jealously guarded. It is almost incredible the amount of labour and effort thus expended by the ryots (the zemindars, as a rule, do nothing) to secure, as far as possible, every drop of the precious element; and it striking-

ly illustrates the actual need that is felt for *more* water, for a more certain and continuous supply, in a district where the natural supply might have been supposed to be sufficient."

2368. Are there only three rivers in the Madras Presidency which rise in the Western Ghâts?—Yes, three large ones, the Godavery, Kistna, and the Cauvery.

2369. Therefore there are only three large rivers whose sources of supply are independent of the rainfall in the district?—Yes, there are the Pennair, the Pallar, and the Northern Pennair, all of which rise in the apex of the country near Bangalore, and they are all doubtful rivers.

2370. How far have those three large rivers been fully utilised?—Not a hundredth part of them.

2371. Are you aware that the Madras Irrigation Company are obliged to shut off any demand upon the feeders of the Kistna during a certain time of the year?—Yes.

2372. There may be a great surplus of water in those rivers which goes down to the sea annually; but the question is how can you divert that water to other parts of the country at a reasonable cost?—Exactly as the Madras Company have done. They are allowed water from June to December inclusive, seven months; a sufficient time for two crops, and all that time there is an immense superabundance of water in the rivers. They have led water out of the valley of the Kistna into the valley of the Pennair, and the principal part, almost the whole of the land, is in the valley of the Pennair, and have carried it across the water-shed, and it may be done everywhere just the same. That has been done very extensively by the natives.

2373-74. I suppose you quite agree that no security could be given to Madras against drought by the construction of tanks which are simply dependent upon the rainfall?—No; the famine showed that.

2375. And you think as to these three rivers that a great deal more might be made of them?—That thousands of tanks could be supplied from them at a practicable cost, there is no doubt about it.

2376. Do you recollect your report which you wrote in 1853 upon the condition of the tanks, and upon public works in Madras?—I wrote a very full report in the year 1837.

2377. There was a Commission, of which Sir George Balfour was Chairman, by which certain provisions were made, that the tanks which were hitherto under the control of the Collectors or the Civil Authorities should be handed over to the Public Works Department; that has been done, has it not, in Madras?—I was not a member of that Commission; my brother was. I do not know.

2378. In the evidence which has been given to the Committee, it seems that there is scarcely sufficient facility given to the Collectors of the different districts in Madras of extending or enlarging the smaller works and tanks because they have no funds at their disposal?—That is the case.

2379. Have you any suggestion to make as to whether those works should be under the Civil Authority?—No, they should not be under the Civil Authority. I would give this fact, and I cannot see how anybody can mistake the conclusion from it. I have got here a large volume, the Madras Administration Report, of 400 pages, and those tanks are dismissed without one

single word of report upon them; what they are doing, they are not doing, what they can do, what state of repair they are in, or anything else. Civilians will not think of them or care a straw about them. There is a report which goes into every detail of the Government of Madras from beginning to end, and here are works upon which four million acres of irrigation depend, of which they do not think it worth while to say a single word. We had one school of Civilians at Madras who understood irrigation, and attended to it. That was Mr. Kindersley's School at Tanjore, and Sir Henry Montgomery, who was sent up to Godavery, and who originated the Godavery work, but we have never been able to get others to take the matter up.

2380. Then you would prefer that even those small works should be under the control of the Public Works Department?—Yes, nothing will be done unless they are under the Public Works Department.

2381. You have suggested a great many schemes and put forward a great many proposals concerning irrigation; there is one scheme in particular which I should like to call your attention to, and it is the one to which Mr. Bright alluded, by which you propose to spend 30,000,000*l*. in making navigable canals all over India; I presume that your figures are a mere estimate?—Yes, of course they are only rough judgments, but taken from the actual cost of thousands of miles that we have cut.

2382. Have you estimated for canals which passed through parts of the country which you have never surveyed?—There are only one or two spots which I have not seen with my own eye.

2383. There was one canal to which you alluded in your evidence which you proposed should run from Cape Comorin to Carwar; that canal could not possibly pay?—I do not see why not.

2384. What would it be used for?—For an immense transit along the whole coast, for internal transit. Why have the Travancore State cut the worst part of it already.

2385. Where does that canal go from?—It is an extension; we have cut bits of canals there which are very imperfect ones, and they have extended them down through the Travancore country, and they have got through the worst cutting on the line.

Sir George Campbell.

2386. Have you examined the country up to Carwar?—I have seen almost every point of it.

2387. Have you seen that part near Carwar?—I have been all along the coast up to Carwar.

2388. Do you think that near Carwar the country is practicable for a canal?—Yes, I went up and examined that part particularly; I saw that end of it, which is the only point which I had a doubt about.

2389. Then it is easy at the end?—Yes, there is nothing to prevent a canal being carried from Calcutta to Cape Comorin, and from Cape Comorin into the Harbour of Carwar, that I can say of my own personal knowledge.

Chairman.

2390. You would propose that for the internal traffic alone?—For the internal traffic and carrying goods to the port.

2391. But there is not much traffic along that side of the country, is there? —We make lines of transport to enable people to carry things; we do not

make them, because they are carrying them already without lines of transport. The mistake about transit is, that you talk about communication, as if they were things to carry what is now carried; they will carry now what is carried, but what they are made for is to make and create traffic; to make it possible to carry things which are not carried now. Was the railway from here to Greenwich made to carry the passengers that travelled by coach, or to create passenger traffic; perhaps not one per 1,000 of the present traffic on that line went by coach; it was the railway that made the traffic, and so with every communication.

2392. But it is a somewhat speculative enterprise, is it not, for Government to go into to create traffic all over India?—That is the grand thing that they have got to do, to create traffic; that is their grand business.

2393. But they may find themselves in very great difficulty by making a system upon which no one can depend, and leaving the railroads along which the traffic will travel?—A great deal could be shown very plainly in unmistakeable figures. Look at the letter of Mr. Leslie, there is no mistake about that; it is quite impossible that anybody in the world can mistake those figures of Mr. Leslie's.

2394. You were equally confident about your figures in connection with the Madras Company and the Orissa Canal Company, which have not been realized?—Because of that one single thing; because they refused to take the water.

2395. But something unforeseen might occur in this grand scheme for the development of traffic?—That may happen of course, but we must act from what experience we have had at present. We have had an immense experience; we have abundant data to go upon; we have spent 170,000,000*l.* on railways, we have spent sixteen millions on irrigation, and we have now abundant data before us to judge of any individual project that is brought forward.

2396. This is the process by which you arrive at those conclusions, but I do not think it is a financially sound calculation; you charge, do you not, against railways the whole of the accumulated interest?—Yes, just as one of the witnesses did against the Ganges canal.

2397. Then you go on to say that the Capital spent on water works, including the Toombudra, is 16,000,000*l.*?—Yes.

2398. The accumulation of interest against the Baree Doab, with the Ganges and other canals, is much more balanced by those to credit on the Cauvery, Kistna, and Godavery works, which have at least ten millions to their credit; you lump all those works together, and you make those works which have paid in Madras, counterbalance all the more recent works which have not paid elsewhere?—Just as I do with the railways; the railways that are paying interest are lumped altogether with those hundreds of miles which are not paying interest.

2399. But then we have to find in India districts or areas, the physical conditions of which will be similar to those of the Delta in Madras, and if irrigation works have, in future, to be conducted under conditions similar to those which have recently failed, it consequently follows that by spending annually a large sum, you will only have in your hands works which will not pay, and against which you will not be able to put the unfinished works,

such as the Cauvery and Kistna?—You must judge of every particular case by its circumstances, no doubt.

2400. But it does not follow that, because it would be wise to spend four or five millions in the Delta of Madras, therefore you should spend twenty or twenty-five millions on other parts of India?—I do not draw any such conclusion; I take the whole cost of irrigation up to this time wherever it has been carried out.

2401. But if you exclude those works in the Delta and certain Sindh works, you will have a very bad balance-sheet?—Not a very bad one; on the Ganges canal, for instance, it very nearly pays its interest; there is very little loss on the Ganges canal, which is the largest work of all, and there it was simply from the fundamental mistake in the projection; they went up into the mountains and spent a million in bringing water out of the hills on to the plains, when they could have got it where they are now getting it, by the Lower Ganges canal in the plain. That was a mistake, but it will not be repeated.

2402. You sometime back made a suggestion, I think, to the Indian Government to establish a great central reservoir in the middle of India?—Yes, on the Toombudra.

2403. But you have never surveyed that scheme?—There is an officer now in England who has surveyed it thoroughly; and I know all the papers about it. I have been up to that part of the country. I know the country; I have seen all the papers and reports about it, and I have talked it over with that officer, who has seen every bit of it.

2404. Do you think that it would add to your undoubted reputation as a successful Engineer if you advocated the construction of a great reservoir in a district which you have never seen?—But I have seen it; I have been up there, as I say, at the very spot, at least to that part of the country, and I know the style of country quite well.

2405. Are you aware that that scheme has been very severely criticised and pronounced utterly impossible?—Yes, like everything else. The Suez canal was denounced as impracticable, and that it would be of no use when it was done.

2406. Surely, people who have been there, and have surveyed the district, are more likely to be right than any Engineer who has not been there?—There is an experienced officer at this moment in England who has as thorough a knowledge of the whole thing as anybody has, and he is entirely in favour of it. I refer to Colonel Fisher.

Sir George Campbell.

2407. Has he made a report?—Yes, and estimated the whole thing.

Chairman.

2408. Have you not put forward some schemes rather with the view of stimulating the energies of the Government, than with the belief that they are perfectly practicable?—No, I never put anything forward but what my immense experience satisfied me that either it could be done, or that it was worth investigating. This is a case where I wish it to be investigated; but as to the Toombudra project, I know it is perfectly practicable.

2409. This scheme for making canals to cost about thirty millions you are aware that Mr. Bright spoke of with the utmost confidence, and he said it was a thing that must be done?—Yes.

2410. Do you believe that there is any Engineer in India who would undertake to do this for 100,000,000*l.*?—I do not know, for I had nothing to do with it; all that I have to do is to show that with the actual data that we have, it can probably be done for that sum. Then let somebody examine it; not a man who has determined that it cannot be done, and shall not be done, but somebody who is heartily interested in it; let him examine it and report upon it. The last time I was examined before a Committee of the House of Commons, it was, in the way of a taunt, said to me, Yes, you would cut a canal from the Sutlej to the Jumna. That very thing is done.

2411. Have you not been rather apt to assume that whenever any report was made unfavourably to your project, the officer who so reported was biassed against you?—Yes: so they all are.

2412. I have read some strong language applied to myself, and you have also accused the India Office, and all the officials, and the Governors-General, and the English papers generally, as being in conspiracy against your plans; is not that rather rhetorical language?—What am I to say. The India Office send me a report, and I answer every paragraph of it. They not only will not prove that I am wrong, but they do not condescend to acknowledge the receipt of it. I write to the *Times* and *Daily News*. Anybody, a lawyer, or anybody that knows nothing about the matter, writes three columns to the *Times* to tell them all about Engineering, whereas, when I write them a reply to it, they will not put it in; that is the real fact. There was Sir James Stephen wrote a letter of three columns to tell the people all about irrigation; he knows no more about irrigation than I do about law; I write an answer to it, and not one of the papers will put it in; these are the real facts.

2413. Why should you assume that a large proportion of people in England, and all the officials in India, should be in this conspiracy so against you, when you can at once put them in the way of greatly increasing the wealth of India?—If they can answer me, why do they not; they will neither allow me to answer those who start those things, nor will they answer what I say. Only just look at the history of the Suez canal. The greatest statesmen in England, the Houses of Lords and Commons, the manufacturers and shopkeepers, the religious and benevolent societies, and the whole of the population of England, were opposed to the cutting of the Suez canal, and it was obliged to be cut by an opponent country, France. Just look at the fact. Which was right? M. Lesseps, or all England.

2414. You think that that is a parallel case to the position which you occupy towards the public as regards this irrigation scheme?—Exactly similar; why do they not answer me.

2415. But it might be possible to reply to you that you have been very fully answered; that you were not content with the answer?—I have got no answer. I have seen none.

2416. Then are you still under the impression that it was a deliberate attempt on the part of everybody connected with India and the public generally, to ignore and put on one side your proposals?—Not everybody; because

things have now made great progress. There are a very considerable number now who begin to look into these matters for themselves; independent people.

2417. You can attribute no other reason or motive for this very improper behaviour, except that it is the wish to protect railways?—Yes; to bolster up railroads; that is the source of the bias.

2418. You stated in your evidence that a very large loss of life during the recent famine was due to railways?—Yes, that is to say, that the railways have not prevented it.

2419. That is not an accurate expression, for when you had said that, you should have gone on and have shown how many lives railroads have saved?—No, the irrigation works have prevented loss of life in those districts of Madras, and railways have not. There are not hundreds of thousands dead in the irrigated districts of Madras, but there are on the railway districts; there is no denying that.

2420. That must be self-evident, because if a district is thoroughly irrigated there cannot be famine in it?—No; then I say that irrigation works do prevent death by famine, and railroads do not.

2421. But supposing there had been no railroads, what would have occurred then?—There would have been more deaths.

2422. Then the railroad has not lost life, it has saved life?—In one sense they have saved life, but they have not prevented loss of life, that is to say, they have been an ineffectual remedy; they certainly have done something, they have helped it, but nothing like what canals would have done if they had been there.

2423. Assuming that canals could have been constructed all throughout the famine districts, and that they would have been amply supplied with water during the two years drought, you say that the loss of life would have been less than it has been?—Yes.

2424. But it is not fair to attribute the whole loss of this life to railroads? —To the failure of the railways to prevent it; that is a fact.

2425. But the railways never undertook to prevent it?—I do not know what they undertook; I am only stating the fact that irrigation does prevent loss of life by famine, and railways do not.

2426. That is to say, by irrigation you mean irrigation which is fed by rivers whose supplies can be depended upon?—Yes.

2427. But you are aware that there are an enormous number of tanks in these famine districts which completely failed and were dried up?—Yes, because they had not been supplied from the great rivers.

2428. Therefore it might be just as proper to attribute the loss of life to the failure of the tanks?—So it was; the tanks were insufficient and they failed certainly in this case; there is no doubt of that.

2429. Supposing your advice had been adopted, and we had no railroads in India, and nothing but navigable canals, and supposing that there had been two years of drought, as there was in Madras, your transport of water would have failed you just at the very time that you wanted it?—Not the slightest; it would not have had that effect at all. There would not have been the slightest difficulty in supplying the canals with water, for they would have been connected with unfailing rivers.

2430. You admit, do you not, that there are only three unfailing rivers in the whole of the Madras Presidency?—Yes; but they would have been supplied from those; there would have been no difficulty whatever about it.

2431. But the connection with those rivers must have been very lengthy in many cases?—Yes, they would have been so in many cases.

2432. Certainly if there had been no rain for two years, what with evaporation those canals would in all probability have been dry?—No; they could easily have been secured with a supply of water; I speak as an Engineer of experience, and I say there would have been no difficulty whatever in supplying the canals with water even in those years.

2433. You speak as an Engineer of experience, but you are merely expressing your opinion upon a system which has not been in force, and which is not in existence, and therefore your opinion is a mere surmise?—It is not surmise; it is the result of my knowledge of the matter.

2434. If an unlimited number of canals be made, you say that there would never be any fear of their not being navigable through want of water?—Never; it would be a very small part of the expense indeed to secure their being supplied with water always; that is the point.

2435. Then, I suppose, you would establish great reservoirs to feed those canals?—In any way; in some places they would lead direct from the river, and sometimes it would be done by storing the water in different ways, according to the particular circumstances of each case.

2436. I do not see any estimate for the cost of those reservoirs in this scheme of thirty millions?—No, it would be a very small amount; when I talk about 3,000*l.* or 4,000*l.* a mile, I include everything; I made an estimate in one instance, for a canal that would cost 2,000*l.* a mile in an out-of-the-way part of the country, where water was not so convenient, and the cost of the water was 100*l.* a mile out of the 2,000*l.*; if the canal cost 2,000*l.* a mile, I consider 100*l.* out of that to supply it with water is not any great sum.

2437. You must recollect that, in the case which I have put to you, the whole of your reservoirs would be dry?—I am speaking now of having a secure supply either directly from rivers, or by leading streams from rivers which never fail, into tanks.

2438. Which is the largest river in Madras; that is to say, which discharges the largest volume of water?—The Godavery is the largest.

2439. During the recent famine the volume of the Godavery was enormously diminished, was it not?—Yes, enormously.

2440. Then it seems to me pretty clear that in a prolonged drought you would not have sufficient water for your canals?—Not from the Godavery; they are not using one-fiftieth part of the water from the Godavery.

2441. You mean at certain times of the year?—No, I am speaking of the whole volume of the river.

2442. The discharge varies very much, does it not?—Yes.

2443. It would be the lowest, I assume, at that time of the year when you would be suffering most from the want of water, and when there would be the greatest need of using those navigable canals; surely there would be danger then of your supply failing?—Never; not the least in the world; the water consumed by the canal is a drop in the bucket compared with the river even when its smallest stream is at the lowest.

2444. Those canals are to be used for irrigation purposes besides?—That is another matter; we are speaking now of transit. If they are used for irrigation, of course they must be supplied with water for irrigation.

2445. Still if you construct those canals which are to serve for irrigating purposes as well as those of transport, you would be in this difficulty in the case of a great famine or drought, that you would either be obliged to refuse the water to the cultivators, or else your transport would cease?—I would keep water enough in the canals for navigation, of course; I would not consume the water that was absolutely necessary for navigation.

2446. Then you would be in this dilemma, that at such times when the people wanted the water, you could not give it them, because if you did give it them, you would stop your transport?—I am only speaking of providing a certain quantity of water for irrigation; and besides that, a certain quantity to secure the navigation.

2447. But at the very time when, above all others, you would want a full supply of water, you must necessarily run short?—As I say, I would supply those canals abundantly for both purposes, from the great rivers.

Mr. Cross.

2448. Is there always, at all times of the year, enough water in those great rivers to supply sufficient water for irrigation and for navigation also?—Yes, for navigation, and for a certain amount of irrigation; but I would only use the water for irrigation when the rivers were held sufficient.

Sir George Campbell.

2449. Is it not the case that in those famines the rain so far failed that the rivers were not full at the time when they were wanted for irrigation?—The Godavery was not full; it only contained fifty times as much water as we could use; it was as empty as that. All I can say is, that there are thousands of millions of cubic yards of water flowing into the sea by our rivers every day, and there is no want of water.

Chairman.

2450. Then the general purport of your evidence is, that you have not altered your opinions in the least?—Not the slightest in the world; the whole thing that has been done has confirmed me more completely.

2451. You are not in the least deterred by that admitted failure to which we have alluded both in the case of Madras irrigation and the Orissa works?—Not the least in the world.

Thursday, 27th June 1878.

MEMBERS PRESENT:

Mr. Agnew.
Mr. Ashbury.
Sir. George Campbell.
Mr. Childers.
Mr. John Cross.
Mr. Fawcett.
Lord George Hamilton.
Mr. Hardcastle.
Mr. Sampson Lloyd.
Mr. Ernest Noel.
Mr. Onslow.
Mr. Pease.
Mr. Edward Stanhope.

LORD GEORGE HAMILTON, IN THE CHAIR.

Lieutenant-General Sir ARTHUR COTTON, K.C.S.I., called in; and further examined.

Sir George Campbell.

2452. I UNDERSTAND the view which you have expressed to be, that now your opinion is that communications are even of more importance than irrigation, but that you consider that railways are so far a mistake, that they are expensive and insufficient, and that water-carriage is much better and much cheaper?—Yes.

2453. And then I understood you to say that, inasmuch as the Indian rivers are in many respects bad for navigation, the Ganges in that respect being, I think, as you said almost as costly as a railway, you wish to supersede that bad river irrigation by artificial canals?—Yes.

2454. And then I gathered, although I do not know that it is expressly stated, that your object was to introduce steam-boat traffic upon those canals; is that so?—Yes; I do not mean to insist upon steam-traffic; I only make them capable of steam-traffic. I fully expect that nineteen-twentieths of the traffic would go on without steam.

2455. You propose to make your canals capable of steam-traffic?—Yes.

2456. I observe that throughout your whole argument and your whole evidence, everything seems to be based upon the assumption that we can obtain water-carriage, such as you wish, infinitely cheaper than railway carriage; what I want to know is this, how far that is a theory, that is your opinion that it might be so, and how far it is justified and supported by existing facts; and with that view, I want to ask you this: putting aside some of the canals in the Delta and the lower coast countries, are there now at this moment any canals in India which are successful in the manner and shape which you describe, or which you would wish to see?—I do not know exactly what you may mean by successful; there are perfectly practicable canals that are now in operation in India for moderate distances; if success means returns in money, I do not know, because no one line has ever been completed.

2457. But out of the districts of the Deltas and the very low coast district, are there at this present moment any canals which are successful in the sense of carrying a very large amount of traffic?—The whole of the traffic of the Delta of the Godavery is carried in immense quantities; there is more carried

by a short line of forty miles from the Godavery to Coconada than the average carried on the great lines of traffic of India by railways.

2458. My question was, excepting the Delta districts, and the very low coast districts, has any canal been successful in the sense of carrying at this moment a very large traffic in any other part of India?—The only canal that could be called so is the Ganges canal, and upon that I have had no particulars for many years. The last time I heard of it, it was carrying about 100,000 tons per annum, but I have not heard of it for several years. To show the contempt with which the whole thing is treated, there is the North-Western Report, in which they do not condescend to mention a word of the traffic on the Ganges canal.

2459. Still you are aware, as a matter of fact, that there have been defects in the Ganges canal which have interfered with navigation up to the last information of that kind, so that there has not been a very large water traffic on the Ganges canal?—I do not know. It was so imperfectly done that, as I said before, there were six essential defects in the navigation of the canal. One of them is so absurd as this, that the loaded boats could not pass under the bridges.

2460. Not making any exception with regard to the low districts, is there any canal in India in which there is an effective and successful steam-boat traffic at this moment?—Not steam-boat traffic, because there are no steam-boats; but the canals are perfectly fit for steam-boats. The canal from the Godavery to the Kistna, ninety miles in length in the Delta, is perfectly effective for steam-boats. I carried the Governor of Madras along it myself many years ago, on that very line, in a steamer.

2461. But there are no steamers upon it?—There is the steamer of the Engineer's Department, which works upon it occasionally.

2462. There is no steam used by the traffic of the country?—No, it is entirely conducted by the natives without steam.

2463. Going beyond India, can you tell us from your immense experience whether in any part of the world, with the exception of one or two large canals which join great ocean or lake navigations, there are great steam-boat canals which are now operating successfully and profitably?—I cannot mention any. There are thousands of miles in France that are regularly worked, I believe, partially by steam, and there are several lines in England that are worked by steam; the Forth and Clyde canal, and the Weaver navigation, and others that are worked by steam regularly now.

2464. Still, since you refer to England and Scotland, is it not the case that since the railways have been introduced, the canals have been, speaking generally, beaten by the railways, and have ceased to be successful, and paying to that degree, that a paragraph went the round of the papers the other day, stating that there were many canals which had been so much disused that they might, with great advantage, be turned to purposes of pisciculture?—My answer to that is this, why does one of the great railways in Scotland rent the Forth and Clyde canal by its own side at 7½ per cent. on the cost. My other answer to that is, that a railway company with 30,000,000*l*. of Capital has been allowed by Act of Parliament to give 100,000*l*. for a link of a canal, and destroy the whole line of communication over and over again in England.

2465. At this moment is it the fact that the Forth and Clyde canal carries a very large traffic at all, to be compared to the traffic carried by railway?—It carries more than a million tons; I do not know what the railway carries by the side of it, but certainly not that.

2466. Is it not the case that the only great steam-boat canal in this island is the Caledonian canal, and that the Caledonian canal had exceptional advantages, inasmuch as the greater part of its course was composed, by nature, of great deep locks, and that, notwithstanding that the canal has been a failure, and that ships prefer the sea-carriage so much that they go round the North of Scotland in preference to using the Caledonian canal?—Because it is not fit for it; because the lake navigation is so tremendously dangerous and exposed to such violent squalls, and with no anchorage, that the ships cannot venture by it; it is in reality perfectly ineffective; it was a grand mistake was the Caledonian canal.

2467. Is there in these islands any other successful canal fit for steam navigation?—Not a single canal in England has been built for steam navigation; if anybody says to me, "Do you know a tramway with a locomotive working on it?" I should say, "No." "Why?" "Because tramways are not made for steam," that is all; but on the Forth and Clyde canal, which was never built for steam, and has most essential defects, it is now extensively navigated by steam, even in spite of those defects.

2468. But it is the fact, is it not, that in England the general body of the canals have been superseded by railways?—Yes; canals totally inefficient and unfitted for the present state of traffic, have been superseded by railways on which 30,000*l.* or 40,000*l.* a mile has been spent; if there was really a steam-boat canal, forty or fifty yards broad, made from London to Liverpool, the railways could not stand the competition a month.

2469. Have any great modern canals, of the character which you would wish to see, been made in France yet?—They are making a grand communication from Havre to Marseilles at this moment, at a cost of 8,000,000*l.*

2470. But it is not yet made, is it?—It is all open in the original state, but it is being improved; I do not know what length of it has yet been completed.

2471. Are there any other parts of Europe where there are any such canals?—There are canals all over Europe.

2472. I mean modern canals fit for steam navigation?—I do not remember any that really have yet been made fit for steam navigation.

2473. With the exception of the Erie canal, which unites the great lake navigation to the ocean, are there any other great steam-boat canals in America for long distances in effective operation?—Yes, there are many canals in America regularly worked by steam, and in Canada also.

2474. Could you mention the most successful of them?—I have got two large volumes of a Report of a Commission on the water-carriage of America lately appointed, in which full reports of all of them are given, but I have not brought them with me to-day.

2475. I understand you to have expressed the opinion that inland water communication is much cheaper than ocean communication; is that so?—Yes, for short distances; not for long distances of 10,000 miles.

2476. When you say short distances, would you say 1,000 miles?—Yes, for 1,000 miles it is much cheaper.

2477. Can you give us any instances in which for a distance of that kind for a traffic of several hundreds of miles inland water communication has triumphed over ocean communication?—No; I am not able to do so. If there was a steam-boat canal from Calcutta to Madras, it would be much cheaper than sending the traffic by ship to Madras.

2478. What I want to know is, whether you can point out to us any case in any part of the world in which an inland navigation has superseded, and has practically been proved to be cheaper and more profitable than an ocean navigation between similar points?—You see I am challenged to give an instance of the very thing that I am complaining has never been done. What I complain of is, that steam has been applied to everything in the world but inland water-carriage. Then it is said, but where is there an instance of an effective steam-boat canal, which is the very point that I am fighting for.

2479. I will take you to a project which we have just mentioned, the canal from Calcutta to Madras, and to Cape Comorin; that is a case in which you would propose to have inland communication which would be, as it were, parallel to ocean navigation, and which you think would be cheaper and more successful; what I want to ask you is this, what is the character of the traffic which you think might be carried by a canal of that kind, and without taking you to any case of a very long navigation, I take the instance which you yourself have given, the completion of the communication between Calcutta and Midnapore, so as in fact to complete the communication with Calcutta. I should like to know what is the goods traffic which would be likely to be carried in such enormous bulk by a canal of that kind?—The very traffic that is now carried on the Hidgly canal which forms part of the line.

2480. I must correct you in that respect; the Hidgly canal is not part of the line to Cuttack; it is the Midnapore line which is part of the projected line to Cuttack?—I beg your pardon; the Hidgly canal is most undoubtedly part of the line between Cuttack and Calcutta, and if the Hidgly canal was completed (eighty miles) to the tidal creeks, navigation would now be open to Cuttack by that line.

2481. I must differ from you there, because I have seen the plans and proposals more recently than you have, and I have always understood that the proposal was that of the Midnapore canal, which is quite different to the Hidgly canal, and which it has been proposed to carry on to Cuttack; but, however that may be, the traffic upon the Hidgly canal is local traffic; the whole of that produced in the Hidgly district is brought up to the port of Calcutta; supposing the canal was open to Cuttack, what goods traffic do you think there is likely to be between Cuttack and Calcutta of a bulky character?—The whole produce of the Delta of Brahmanee and the Mahanuddy, would come by the lines that you have mentioned, the Hidgly tidal canal and the high level canal, as we called it, to Midnapore. They are two parallel lines, one going through the heart of the Delta, and the other skirting the upper side of the Delta, and they would both equally connect Cuttack with Calcutta.

2482. Of course, if they were both prolonged, but the whole question is of the produce of the Deltas of the Mahanuddy and the Brahmanee coming up to Calcutta; are you aware that both the produce of Orissa and the produce of Bengal is generally in excess of the needs of the people, and that both those provinces habitually export rice?—Yes, I daresay they do.

2483. So that the surplus produce of Orissa is not consumed in Bengal, but is generally exported to Madras, the Mauritius, and other countries; are you aware of that?—Yes.

2484. Do you think it at all likely that, considering that the trade from Calcutta is an export trade, so long as there are the means of exporting the grain direct from the ports of Orissa, it would be taken up to Calcutta by a long inland navigation, and would there incur the expense of the port of Calcutta and the river Hooghly, and would be re-exported from Calcutta?—I am not theorising, I am simply stating facts. Here is a canal; that part of the way to Cuttack ends at nothing in the middle of the Delta, and carries 150,000 tons a year. How can I possibly question if the canal was put in communication with Cuttack and the whole Delta, and the whole upper basin of the Mahanuddy, that there would not be much more than 150,000 tons carried along it; there can be no question about it.

2485. If it be a fact, as I assume it to be, that the surplus produce of Cuttack seeks an outlet to the ocean; if you look at the map, and see how much nearer the Orissa ports are as an outlet to the ocean, how can you suppose the grain to travel some 250 miles to Calcutta first, and then be exported from Calcutta?—I beg to say that I am not theorising; it is not my theory. I mention the fact, that 150,000 tons were carried last year by the Hidgly canal from the heart of the Delta, and that, therefore, we cannot but be certain that if that canal was continued into the body of the Delta, and connected with the whole Delta of the Mahanuddy and Brahmanee, that there would be much more carried than there is now, when it ends at nothing.

2486. Is there not some confusion in what you have told us about the Delta; are you not aware that the Hidgly canal drains a district which is part of the Delta of the Ganges, and that it does not at all follow, because the produce goes to the Ganges Delta, which is immediately adjoining Calcutta, that, therefore, the produce of the Delta of the Mahanuddy, 250 miles distant, with an easy communication with the ocean much nearer, that that also should go to Calcutta?—I am quite certain of this; it is one single tract of country, although part of it is the Delta of Mahanuddy, and part of the Brahmanee, and part of the Hooghly; it is all one tract of country, and if a canal going part of the way carries 150,000 tons sixty miles from Calcutta, if the whole 250 miles were completed, the traffic would be enormously increased. I cannot see how we can possibly come to any other conclusion than that. I am as certain that the traffic would instantly double, if that eighty miles was completed, as I am of anything.

2487. You are aware, are you not, that between Midnapore and Cuttack there are a large number of very large and heavy mountain torrents which cross the line of the proposed canal?—Yes.

2488. So that, consequently, the canal would be somewhat expensive in character from an Engineering point of view?—Yes, it is estimated at 6,000*l.* a mile; a very expensive canal.

2489. Are you aware that the estimates for the other parts of that scheme have been very largely exceeded, and that it is not impossible that this estimate also will be exceeded?—Very likely, but they have got very good data now. They have carried it seventy miles from Calcutta towards Midnapore, and they have carried it sixty miles from Cuttack towards Calcutta; that is

130 miles, and it wants 120 miles of continuation of that same canal to Midnapore to complete it; and having the data of the first sixty miles, they cannot be much out in estimating the remaining 120 miles.

2490. Are you aware that that 120 miles is the most difficult part, crossing a great number of the largest streams?—They have already crossed the Brahmanee, by far the largest river there.

2491. You will admit that the probability of that canal paying would depend very much upon the assumption that the grain of Cuttack would go to Calcutta?—I think there will be an enormous traffic of various kinds of grain, and other things, along it, but I think it is not the best line of the two. I think the lower line, the Hidgly line, would be a line of greater traffic.

2492. About the Godavery traffic; I think Colonel Crofton told us that in reality the navigation returns from the Godavery canals are not large; is that so?—They are very small, because the toll is perfectly nominal. At first I never mentioned a word of toll; I was so afraid that they would put a toll on which would paralyse the traffic, but at last they insisted upon it, and then the Engineer who was then in charge, proposed a plan by which, without meddling with the boats in *transitu*, which is the great point, they should merely put a license tax upon them, and that so small as to be quite nominal, in order that it should not interfere with the traffic.

2493. Then the advantage of those canals for the purposes of navigation is indirect, and not in the shape of direct Revenue return?—Yes; I would like to add, that as the irrigation pays over and over again the interest of all the expenditure, and as there is no wear and tear of the water in navigating the canal, of course the interest of the State is that these canals should be used to the utmost, and should be perfectly free.

2494. At present they are used entirely, or almost entirely, for the local traffic, are they not, for the transfer of the produce of those Delta districts to the port of Coconada?—Yes.

2495. Then about the Cauvery; on the Cauvery canals is there the same system of navigation?—We never made a system of navigation in Tanjore, which is a terrible defect.

2496. At this moment is there no canal navigation in Tanjore?—No; the river is navigated a little, but it is very imperfect navigation; that is the great advantage that the Godavery has over Tanjore.

2497. Except the Godavery canals, can you anywhere point to any successful canal now in operation in India as navigation canals?—I may perfectly safely point to the Hidgly canal; that is quite a success; it has been open a very short time, and it has already 150,000 tons traversing the canal, though it ends in nothing.

2498. You are aware, are you not, that the Hidgly canal is an old tidal canal which has been improved?—The present canal is entirely a new work.

2499. But it is an improvement of an old one?—No, it is entirely a new work.

2500. Are you not aware that there was a good deal of navigation there before?—Amongst the winding creeks, but the canal itself is quite new.

2501. And the Hidgly canal is a canal executed in the Delta of the Ganges?—Yes, it is between the Hooghly and the Brahmanee; which precise portion it belongs to I do not know.

2502. You are of opinion, are you not, that a great deal more may be done to improve the water communications of the Delta of the Ganges?—Of course.

2503. And that the whole Delta of the Ganges ought to be completely pervaded with a system of canal navigation?—Yes.

2504. You have alluded to the particular case of the communication between Calcutta and Goalundo, the point where the Ganges and the Bramapootra join, and I think you stated that the railway which now runs on that line does not carry more than one-tenth of the traffic?—That is what Mr. Leslie states.

2505. I will say, a small portion of the traffic; but notwithstanding that, the railway pays?—Yes.

2506. It is a fact that the other nine-tenths of the traffic, or whatever the proportion may be, is at this moment actually carried by water-carriage, is it not?—Yes.

2507. So that there is existing water-carriage of some kind?—Yes.

2508. You are aware, are you not, that a great part of the water traffic does in fact now come to Calcutta by the Eastern canal and Tolly's nullah, which is a somewhat rough and imperfect old canal?—Yes.

2509. And that that canal is exceedingly profitable to the Government, and that the only defect is, that it is not sufficient to meet the existing wants of the navigation, and that on account of its tidal character, and the occasional blocks in it, it is not so effective as it might be?—It is only a little short bit. The main line of traffic between Goalundo and Calcutta is about 350 miles of tidal creeks. There is only a little part of it that goes by canal.

2510. You are aware that at present the canal does communicate with the tidal creeks, which afford good navigation, and that if that canal was only in good order, so far as boat traffic is concerned, there would be a very good water communication between Goalundo and Calcutta?—Not very good. I should say very bad. It is 420 miles round from Calcutta to Goalundo by canal and the river navigation, and it is so bad that they are obliged to anchor every night, and they take six weeks to do it.

2511. When you say that there is 420 miles by river and canal from Calcutta to Goalundo, will you allow me to ask if you would refer us to any figures in support of that statement, because it is entirely contrary to my local experience?—It is all expressly stated in the minutes of the present Governor, and I could quote it if necessary, and also in a formal report made by the Engineer on the Goalundo Railway Station.

2512. Are you not mixing the steam-boat navigation which goes round by the Sunderbunds, with the boat navigation which takes the direct route by the canal; do not you think that you are alluding to the steam-boat route by the Sunderbunds?—I am speaking of the main communication between Goalundo and Calcutta for goods traffic.

2513. I quite admit that the steam-boat traffic goes a very long way round, but what I want to bring you to is this: that we have a canal which brings boats by a route which is very tolerably direct?—The Bengal Administration Report for the year 1875-76 says this: "The attention of the Government of Bengal has been repeatedly drawn to the circuitous route which the river traffic between Calcutta and Eastern Bengal is obliged to take. Besides being circuitous, it is in some parts dangerous, especially in those parts which fall within the rivers Patta and Megna. Although some portion of the traffic is

taken off by the Eastern Bengal Railway, still the greater portion follows the water highways, notwithstanding that these waterways are so tortuous as to be lengthened out to an excessive distance. It is calculated that a laden boat, plying between Eastern Bengal and Calcutta, travels some 200 or 300 miles more than it would if there were anything like a straight road by water. The obvious remedy will be to construct a canal for navigation across the country from Eastern Bengal to Calcutta," and so on. That is not what I say, it is what the Government of Bengal says.

2514. You have not got the original report from which this is taken; I observe that this is in inverted commas; is not this a quotation from a report of Colonel Haig, or some Engineer officer?—I forget whom it is signed by; it is a quotation from a communication from the Government of Bengal to the Supreme Government.

2515. Does not the extract which you have just read say that the Bengal Government have been sincerely anxious to improve the defective character of the canal communication between Calcutta and the Eastern districts?—I do not know about their anxiety, but I know that it has produced no result.

2516. And are you aware that they have had submitted to them repeated projects for the improvement of those communications?—Yes, that is exactly the point; we hear of any number of projects, and they call for any number of projects, but they will not do anything.

2517. Still you believe that that might be done?—Of course it might; it is the simplest thing in the world.

2518. I have not seen it myself, but I gather that you have yourself made a project of a canal to connect Calcutta with Goalundo; is that so?—Not with Goalundo, but with the main Ganges. My project was to carry a line of canal to the nearest point of the Ganges.

2519. To what point?—Somewhere about Cooshtea.

2520. May I ask you to explain the character of that project; was it to be a tidal canal, or how was it to be supplied with water?—It was to be a steam-boat canal, with locks; but since that, allow me to say, there has been another greater project, and a far more complete one, planned by Colonel Rundall, for putting a weir across the Ganges at Rajmahal, and bringing a steam-boat canal all the way from there to Calcutta.

2521. As I understand, that letter of Mr. Leslie's, to which you allude, has reference to a project for a canal to some of the Eastern districts; is not that so?—That canal would serve both. It would drop the Western traffic with the Goraee, and convey the Eastern traffic on to Goalundo.

2522. It is proposed to carry that canal somewhere near Jessore?—The line that you have named was direct to Goalundo, and it would pass Jessore, and cross the Goraee, and at the Goraee it would drop the Western traffic.

2523. How is it proposed to supply that canal with water?—By pumping.

2524. Then it was to be a high level canal supplied by pumping?—Yes. This was one point in my project about this line, that it is incomparably cheaper to make the canal above the water-level, and pump the water into it, than to cut it down to the tidal water, and Mr. Leslie agrees with that.

Mr. Fawcett.

2525. Why is it cheaper?—If you have only to cut one yard deep, and make an embankment on each side, so as to give you eight or ten feet of

water, of which six, we will say, are above the level of the country, the excavation is a mere nothing; whereas if you have to cut down below the tidal water to get into the deep mud of the river, it is a very heavy and enormously expensive thing. You get into the semi-fluid mud of the Delta, and then it becomes a very expensive undertaking. But five minutes' calculation will show that to pump the water up eight or ten feet to the level of the canal, is a mere trifle compared with the additional expense of cutting a deep canal.

2526. How would you make the canal water-tight?—All the Delta land is water-tight.

Sir George Campbell.

2527. Then I will ask you this: the plan is for a high level canal, and you are aware that that canal must cross a large number of great rivers?—Yes.

2528. You have yourself instanced the Goraee, how is it proposed to carry it across that great river?—Over the Goraee by an aqueduct.

2529. Is it to be carried over all the rivers by aqueducts?—There is no very large river except the Goraee on the line; there are several small ones, and the canal must be carried over them all by aqueducts.

2530. You are aware, are you not, that the Goraee is a river so large that to build the railway bridge over the Goraee was a very great and very difficult undertaking, and not effected without some misgiving as to the stability of the foundations and other difficulties; but there are several other rivers which are only small in comparison with the Goraee, but which, compared with the Thames, or any rivers which we know, would be considered enormous rivers, and this canal must be carried by aqueducts, must it not, over all those rivers? —Yes.

2531. Is it not the case that the expense of aqueducts to carry a large steam-boat canal over those rivers would be enormous?—We are not in a position to go into detail; Mr. Leslie sketched out this plan, which is, in his estimation, quite feasible, and the Government called upon the Engineers to examine, and investigate, and estimate the project; I have not seen their report.

2532. You are aware, are you not, that the great expense of the Ganges canal was due to the enormous sum, I think a good deal more than a million sterling, that was expended on the aqueduct to carry that one canal over one very small hill stream, which is a mere drop in the ocean compared with the Goraee?—It would not cost anything like a million to carry an aqueduct over the Goraee.

2533. You are not aware that the Solani aqueduct cost something like a million?—It perhaps cost a quarter of a million; the whole canal from Hurdwar to the plains only cost a million.

2534. At any rate that was one cause of difficulty?—The canal from Hurdwar to the plains, the whole line, including the Solani aqueduct and several others of some forty or fifty miles, cost a million.

2535. Still you are aware that the drainage encountered by the Ganges canal in that little bit of country was a mere trifle compared to what this canal to Goalundo would encounter in the great rivers of the Delta?—No, I do not know that; on the contrary, there was an immense amount of drainage crossed by that canal.

2536. Now I will take you to the line of the Upper Godavery; have you yourself seen what is called the third barrier?—Yes, I have crossed there from Chanda to Seroncha. I know the country quite well.

2537. Did you come down the river the whole way?—I did not come down the third barrier; that is impossible.

2538. I mean, have you examined the river the whole way?—No, I know it by report. I have had Colonel Haig's report and estimate on the line, and I traversed the line by which he was bringing the canal.

2539. Are you aware that what is called the third barrier, is in reality a tract of country of fifty or sixty miles in length, in the course of which the river descends several hundred feet?—I forget what the fall is, but all that was thoroughly examined and investigated, and estimated, by Colonel Haig.

2540. At all events, that third barrier could not be overcome, except by the canal going round that tract of country, with a lockage of several hundred feet?—I forget the exact amount. I think it was a descent of about 150 feet, or something of that sort, in about thirty miles, but that has all been estimated and examined.

2541. From the Delta to the top of the country you yourself stated the total ascent to be about 1,100 feet?—Yes, up to the water-shed, between the Wurdah and the Poorna.

2542. You have yourself admitted, I think, that the present scheme for the navigation of the Godavery proposes only to get over the difficulties at certain points, but to trust to the river navigation for the greater part of the distance?—Yes.

2543. And that the river navigation is not available for, at all events, a good many months in the year?—No, not for about four to five months in the year.

2544. So that it would be a broken and imperfect navigation?—Yes, unless you supply it with water. It is like everything else. If you build nine arches of a bridge and leave the tenth unfinished, you cannot go along it. When I propose a project, instead of working according to the project, you leave out this and leave out that, and stop it in the middle, and then say, look at your project.

2545. Have you yourself ever proposed any definite project for supplying the Godavery with water, so as to make it navigable all the year round?—I do not know that I have ever made any special report upon it, but so far as a line of that kind can be calculated for, the plans and estimates are all completed for it.

2546. Have you yourself ascertained it to be practicable?—I am perfectly satisfied with the reports that I have seen for making large reservoirs up in the upper part of Nagpore.

2547. You have told us that the Godavery is an enormous river, which, at a certain season of the year, carries an enormous quantity of water?—Yes.

2548. And at other seasons of the year it is so dry that it can be easily waded over, is it not?—Yes.

2549. Granted that for a still-water canal it may not be beyond Engineering skill to store up sufficient water to make the canal available for navigation, is it not the case that to apply such an amount of water as would make that great river channel navigable at all seasons of the year, would require an enor-

mous quantity of water?—No, that has all been calculated. We know just as well as we know how much water it would take to fill a bucket. The river in the shallowest place is now a foot deep when it is the dry season, and we know exactly how much it carries when it is three feet deep, and that is the difference in quantity to be supplied for so many months, and that is the quantity that we want; we have abundant data now for knowing what it would cost to store the water in large reservoirs on the upper part of the district. It is all a mere matter of calculation, as simple as possible.

2550. Is it not the fact that the Godavery channel, being a very large and irregular channel, involving a very considerable stream, the supply of water to render that channel navigable must be far greater than any that is supplied to any existing channel?—Of course, it is enormously greater.

2551. May I ask who has made the plans and estimates, and calculated for the reservoirs which would contain the supply of such an enormous quantity of water?—That has all been planned and estimated, and the reports have been before the Government for years.

2552. By whom?—I do not recollect the name of the officer who planned the large tanks, but they have been before the Government for years.

2553. You will excuse me for saying that I have had before me the reports made by officers of the Madras Engineers, but I do not think that they have ever gone the length of making plans sufficient to supply the Godavery with water; could you give us any indication where those reports are to be found, or who the officers are?—There is an officer in England now, Colonel Fisher, who knows all about them, and he can tell you all about the reports and the estimates.

2554. Has Colonel Fisher examined the upper stream of the Godavery?—The place where they propose to make those large reservoirs are the feeders of the Weingunga, which falls into the Wurdah, and so into the Godavery. I think Colonel Fisher examined them personally, and he knows all about it. When that water is passed down, and has given a navigation of 500 miles of the Godavery, it will be worth ten times what it has cost to supply the Delta of the Godavery in the dry season.

2555. For navigation purposes?—Both for navigation and for irrigation.

Chairman.

2556. You have told us that a great many things have been estimated as regards this navigation of the Godavery, but so far as we have gone, all the estimates that have hitherto been made, as regards cost, have been utterly erroneous?—Of course they have; how could they be otherwise. An officer sends in an estimate (not an estimate by-the-bye, for I believe that the first mention of it was merely a rough guess) in 1853, and the works that have been hanging on, a bit done this year, stopped next year, gone on again next year, and so on, till the value of money is one-third of what it was. How can an Engineer be responsible for that?

2557. Still that would not affect the cost of finishing their work now; there may have been a rise in the prices, but as we have got to deal with present prices, the cost of the canal would be correspondingly increased?—The works have been almost completed for 700,000*l.* working up to within a few years; that is a positive proof that if 300,000*l.* had been given in 1853, twenty-five years ago, it would have been amply sufficient to have completed the work.

The excess of estimate is, of course, charged to us, because those who have done it are their own judges, and they say such a charge and such an estimate was exceeded.

2558. Was not the original estimate made by Colonel Haig, 80,000*l.*?—I do not remember. I think I myself, or my brother, stated roughly that probably 300,000*l.* would do it, before any estimate was made, and now we have positive proof that it would have been amply sufficient if the works have been carried out with ordinary energy; that is to say, if 50,000*l.* or 60,000*l.* a year had been given to them.

2559. In a report which was sent home to the India Office by the Indian Government, which, I assume, was correct, it is stated that Colonel Haig's first estimate was 80,000*l.*, and that it was sent back to him, and, upon revision, he adhered to his estimate of 80,000*l.*; are you aware of that?—I do not know that.

2560. You never heard of that report?—No. Very probably it was for the first barrier.

Sir George Campbell.

2561. When you say that the thing has been nearly completed for 700,000*l.*, do you mean that the second barrier has been nearly completed?—Yes.

2562. Is it not a fact that by far the most difficult work, namely, the third barrier, has not been touched?—Yes; but when the second barrier was completed, it was a complete work; that is to say, access was given to about 5,000,000 of people occupying a populous and fertile country.

2563. Excuse me; where are those 5,000,000 of people, and where is the populous and fertile country, for I was about to ask you, is it not the case that the second barrier leads through an almost uninhabited and deserted country, little more than a jungle?—It is quite the contrary; it is an exceedingly fertile, populous, and thriving country on the right bank of the Godavery from the second barrier. They have 100 miles of river navigation above the second barrier, and all that is through one of the very finest and most fertile, populous, and thriving countries in India.

2564. Will you be so good as to say in which district that country is?—It is chiefly Hyderabad; almost all in fact.

2565. You are aware, are you not, that the British side of the river, at all events, is anything but prosperous and populous?—Yes; up to the Wurdah it is a very thinly populated country.

2566. Then coming toward the third barrier, it is, is it not, the case that it is thinly populated on both sides of the river?—Yes, it is up to near Hinganghat.

2567. As far as British territory is concerned, you will not tap the populous and fertile country until you have surmounted the third barrier, which has not yet been touched?—No; then with the third barrier you get to the coal and oil seeds, and teak, and all the produce of the Central Provinces.

2568. At the present moment is there any boat traffic on the Godavery above the second barrier?—I have not heard for three or four years, but the last I heard was that there were 24,000 tons of traffic; somebody said 24,000*l.*, but it was not so, it was 24,000 tons of traffic up the river at that time. I do not know whether it has increased now or not; I have not heard.

2569. Supposing that the Godavery could be canalised up into the Central Provinces, and a sufficient supply of water to make it a really efficient means of water navigation should be produced, I should like to go back to the question which was mooted when you were last under examination, as to the traffic which would be carried upon that canalised river. Do you seriously mean to express the opinion that the coal of Chanda would be likely to compete successfully, say in the market of Madras, by that route, with the coal of a superior quality which exists in enormous abundance within 100 miles of Calcutta, which coal mines are connected with Calcutta by double lines of railway, which, if it was necessary, might, without much difficulty, be connected by a canal; do you seriously think that in the market at Madras the Chanda coal could successfully compete by that route with coal brought by sea from Calcutta?—There would not be the slightest chance of competition on the part of the Calcutta coal; Madras would inevitably be supplied with coal from Chanda, and so would Coconada.

2570. Is it not a fact that, as a mere matter of distance, Calcutta is almost as near as Chanda to Madras?—There is not much difference; I think Calcutta is about 1,100 miles from Madras, and the other is about 700; but there would be no chance between the two.

2571. Although there is fine sea communication between Calcutta and Madras?—The mere expense of getting a ship out of the river in Calcutta would be more than the whole cost of carrying the coal from Chanda to Madras by canal.

2572. Does not that altogether depend upon the event that internal water communication can be made cheaper than sea communication?—Yes.

2573. Then beyond the coal, what else do you think is likely to be carried?—What would be brought down would be cotton, coal, oil seeds, timber, and wheat, and other produce; and what would be taken up especially would be an enormous quantity of salt. If that water navigation was opened, at least ten millions of people would be supplied with salt from the Godavery district. May I add, that when we went up the Godavery the first time we went up in a steamer, and we called at different villages to show the people the steamer. At every one of those villages the first thing they said to us was, "But will you bring us salt?" There is no doubt that to get salt cheap is a great desideratum for the people up in Central India.

2574. Are you aware that at present Bombay salt is brought at a very cheap rate by railway?—It costs a penny a pound in Nagpore.

2575. Are you aware that by far the greater part of that cost is the Government tax?—Yes.

2576. Which would be imposed, whether it came by water or whether it came by land?—Yes.

2577. Are you prepared to give it as your opinion that the cotton of the Central Provinces would be taken to Coconada rather than by rail to Bombay?—Yes.

2578. Do not you think that so expensive an article, as pressed cotton, will bear railway transit?—It would bear it; but it would, of course, go by the cheapest line.

2579. In England do you think there is any cotton now carried by canal in preference to the railway?—Not only cotton, but manufactured goods; and I

have heard a manufacturer of Manchester himself, when somebody said, "Why do you carry manufactured goods by canal from Manchester to Liverpool, why do you not carry it by railway?" say, "Because it is preferable."

2580. Is it the case that a large proportion of the manufactured goods of Manchester goes to Liverpool by canal?—Yes, an immense quantity.

2581. I think there must have been some mistake in your evidence when you said the cost of carrying cotton from the Central Provinces to Bombay by railway was 2*s.* 2*d.* per ton per mile?—No, it is 2½*d.*

2582. I understood you to say that it was an entire mistake to say that there were mountains on the West Coast of India; is not it the case that all the way from Surat to Beypore there is a wall of considerable mountains known as the Western Ghâts?—That was not the line we were talking about. The line from Bombay to Karwar is an impracticable line. It was the line from Karwar to Cape Comorin we were talking about.

2583. Is it not the case that between the coast and the interior the whole distance from Surat to Beypore is a chain of mountains known as the Western Ghâts, which are without any break, and which it would not be possible to traverse by any canal without locking it up 2,000 feet high?—You ascend 2,000 feet, but there is a complete breach in the line of ghâts by the line of the Kala Nuddee, which flows from near Dharwar to Karwar.

2584. What is the lowest point in that breach?—About 2,000 feet, I think.

2585. There is no part lower than 2,000 feet, is there?—No, not there.

2586. With regard to those main lines of canals, you believe that those enormous reservoirs might be constructed, by which even such great rivers as the Godavery might be rendered navigable in the dry season; in any part of the world do reservoirs on that enormous scale yet exist?—In Bombay they have two actually constructed now. One of the two, on the line near Sholapore, would go far towards, I am not sure that it would not quite keep, the Bhima navigable all the year.

2587. Are not those tanks devoted to a comparatively small irrigation system?—They only use a small part of the water; but I am not speaking about the use made of them now, but what use could be made of them in the way of navigation.

2588. At present does there exist in any part of the world, in actual practice, a storage of this kind, which is sufficient to supply a great navigation?—There have been great reservoirs constructed in various parts of the world.

2589. I mean on so large a scale as you propose?—Not so large, I think. I did not propose them; but they were proposed for Nagpore to contain 2,000,000,000 cubic yards of water; but there are some enormous ones in France constructed, not for purposes of navigation, but to prevent floods.

2590. What are those main lines of navigation which you think might be established?—From Calcutta to Kurrachee, up the Valley of the Ganges, across the water-shed of the Jumna and the Sutlej, and down the Valley of the Indus to Kurrachee, that is one; and the worst part of it is now actually cut, the Sirhind canal, across from the Sutlej to the Jumna. The second is by the line of the Godavery and the Taptee from Coconada to Surat. The first one crosses the country at about 1,100 feet above the sea, and the second one at about the same level; then the third, up the Valley of the Toombudra

and the Valley of Kala Nuddee, crossing the water-shed near Dharwar, which is the worst one, 2,000 feet, reaching the sea at Karwar. The fourth is by Palghaut, a breach south of the Neilgherries, going up the Valley of the Ponany and down the Valley of the Ambravatty, crossing the water-shed near Coimbatore, on a level of about 1,400 feet. Then the two coast lines of course meet at Cape Comorin.

2591. Take the line from Calcutta to Kurrachee; you would have to begin with a great canal from Calcutta to Rajmahal, which would be a very expensive undertaking?—Yes.

2592. Do you know the height of Rajmahal above Calcutta?—It is about 100 feet, I should think.

2593. Then from Rajmahal what line would you take?—I would carry it on to Monghyr along nearly parallel with the river, where it would meet the Soane canals.

2594. Are you aware that that would be an undertaking of very great Engineering difficulty?—No; I have seen it, and I have examined the line. There is one place where it would go round the end of the hills, where there is a little bit of tunnel on the railway.

2595. Are you aware that it has been extremely difficult to maintain the line of the East India Railway, that the Ganges has repeatedly threatened to wash away, and has washed away, parts of it?—It is easily protected.

2596. Has any estimate been made for that part of the plan?—No, not that I am aware of.

2597. Then crossing the lines of the Soane project, are any fitted for steam navigation?—So far as they have been allowed to be executed, but, like everything else, they have been stopped, and stopped, and stopped, and nothing carried out.

2598. Then the lines of the Soane are not fitted for steamers?—Yes, so far as they have been carried, they are fitted for steamers of 250 tons. You can go now from near Chunar, on the Ganges, about, I think, 150 miles, to Patna by steam-boat canal.

2599. Then the project has been that the Soane canal should be carried Westward as far as the River Kurramnassa; how would you get from the Kurramnassa to Allahabad?—I have examined that line, and it is a perfectly practicable line.

2600. It does present very great Engineering difficulties, does it not?—No, not at all.

2601. Has it been estimated?—I do not think it has; I do not know. I have been along it, and I know that it is a perfectly practicable line.

2602. Then you would use the Ganges canal and the Sirhind canal?—The navigation would go by the Lower Ganges and the Ganges canals, which would be connected at Cawnpore. That would involve an aqueduct across the Jumna at Allahabad.

2603. I suppose you do not doubt that it would cost many millions of money?—No, nothing like it.

2604. Do you know what the lattice railway bridge has cost?—No, I do not.

2605. Are you aware that it cost at least half a million?—I never heard; it ought not to have cost that.

2606. At all events, the railway bridge over the Jumna, although it is a mere iron lattice bridge, has cost a sum something very much larger than almost any one bridge that we have any knowledge of?—I do not know what it cost; I only know that the thing is quite practicable within a moderate expense.

2607. Have you ever made an estimate for making an aqueduct for the canal across the Jumna?—We have an aqueduct on the Godavery across the sandy bed of the river, just about the same width as the Jumna, which is now traversed by the navigation. It is thirty feet broad, and costs 30,000*l.*

2608. No doubt it would involve a large expenditure of money to make the Ganges canal fit for steam navigation, would it not?—The Ganges canal is practicable for steam navigation at this moment I have no doubt, but it might be greatly improved.

2609. Must not all the bridges be removed?—No, they have been all altered.

2610. To the extent of making them fit for large steam navigation?—Yes, quite.

2611. And is the Sirhind canal already fitted for steam navigation?—Yes, that is a canal which could carry steamers, it being 110 yards broad.

2612. From Loodiana to Kurrachee nothing whatever has been done in the way of a canal, has there?—Nothing at all.

2613. Several large rivers would probably have to be crossed?—Yes.

2614. And no estimate has been made for that line?—No.

2615. No doubt that a great undertaking of that kind would cost a very large sum?—Yes, but then we have cut thousands of miles on that line, and therefore we have ample data. We have cut, or are cutting, about 700 miles of steam-boat canal between Calcutta and Loodiana.

2616. Is it not the case that the existing canals have been designed to go over the easiest ground, and that the most difficult ground by far remains untouched, and even unestimated for?—No, that is not the case.

2617. Now to come to the subject of irrigation; Colonel Crofton told us, as a matter of reference to the official records, that those records showed that at the time when we took over the country of Tanjore, the irrigation was as much as 700,000 acres, and you have told us that it is now 740,000 acres; I understood you to have said, nevertheless, that from some calculation which you made with reference to the amount of Revenue received, you supposed that forty years ago the Tanjore irrigation was not nearly so large as had been supposed; I want to know whether you are prepared to contradict the definite statement which Colonel Crofton has made to us as coming from official returns, of the time when we took over that country, that the extent of the irrigation was actually as much as 700,000 acres, and consequently not much less than it now is?—Yes; my reply to that is, that there are the Government statements, that is all. There is the actual wet assessment, as we call it, of the Government lands at the time when we began the works in Tanjore, and they show, I think it is, 420,000 acres irrigated of Government land. There was a little more of zemindary land besides; perhaps 500,000 acres altogether. That is an actual Government return.

2618. I understood you, in your last day's evidence, to say, not that the Government returns showed an irrigation of 420,000 acres, but that the

Government returns showed a certain Revenue, which you, calculating it at the rate of five and a half rupees an acre, deduced as showing that there could only have been 420,000 acres of cultivation?—We stated it accurately at the average wet assessment, five and a half rupees. There is no mistake about it.

2619. You think that Colonel Crofton was wrong in stating that it was 700,000 acres?—Yes. I know the district better than Colonel Crofton, and there is the actual statement in the Government return.

2620. Can you put in that statement to which you refer?—I have given it in my evidence last time. All the figures are given.

2621. Then it comes to this, that you think Colonel Crofton is wrong?—You cannot imagine how curious all this is to me. If you were to go and ask a native, "Has there been any increase of irrigation since the anicuts were built," he would laugh in your face.

2622. What I find you said was this: The assessment you say, in 1832, was 2,380,000 rupees, which, at an average of five and a half rupees per acre, gives 420,000 acres; you did not state the records anywhere showed that it was 420,000 acres, but you deduced that from the amount of Revenue?—But that is perfectly well known. It is recorded in fifty places. I could show it you in the last Madras Administration Report.

2623. What is the present rate of assessment?—Five and a half rupees is the average tax on irrigated land. The average tax on dry land is a rupee and a half.

2624. You are aware that, forty years ago, the Revenue was collected on a totally different system, namely, it was collected upon a proportion of the produce per acre?—Yes, but still the average was the same.

2625. Now, as regards the Revenue, I think you gave us to understand that there had been a very large increase in the Revenue of the Tanjore district, and also of the Godavery district; you calculated it to be about 80 per cent., I think; what I want to understand is this, does that increase include all the sources of Revenue, or only the land-revenue?—All the sources.

2626. You are aware that in that period the salt tax has been very largely increased, and that other taxes have been increased, and the sources of Revenue, other than land, cannot be directly attributed to the canals?—In a great measure they are, because the people have been enabled to pay them. It would be of no use having a salt tax, if the people had not been enabled to buy the salt.

2627. Can you tell us the exact amount of increase of land-revenue in the Tanjore and Godavery districts?—No, I cannot at this moment, but I could easily get it. What I say is this, as to the 20, the 26½, and the 91 per cent. return on the irrigation works, they are the actual increase from water-rates, and do not include any increase from the improved condition of the people. Then I say here is a district, the Revenue of which has increased by 350,000*l.* Does not everybody in the world know that a great portion of the increase of Revenue, besides the water-rate, is due entirely to the improved condition of the people.

2628. Still you admit that the whole of that 80 per cent. increase is not directly due to canals, because it does not directly come from canals, or from land watered by canals?—It is simply the increase of the water-rate.

2629. Can you say that the increase of the land-revenue is more than 50 per cent. ?—I do not recollect exactly what the increase of the land-revenue is, but it could be found in the last Madras Administration Report.

Mr. Sampson Lloyd.

2630. Over how large a district was this 300,000*l.* increase obtained ?—There is an increase of Revenue in the whole Delta of the Cauvery of 400,000*l.*, and in the whole Delta of the Godavery, of about 330,000*l.*

Mr. Onslow.

2631. Since what year ?—Since we began the works; in Tanjore it is since 1836. The works have been gone on with all the time, and the increase of the Revenue of the Kistna also has been 330,000*l.*

Sir George Campbell.

2632. That increase is since the year 1830, is it not ?—The Tanjore increase is.

2633. And it is about 80 per cent. upon the Revenue of that time ?—It is about 80 per cent. in Tanjore alone.

2634. Of which a large proportion comes from salt and other sources ?—Yes.

2635. You have of course looked at the returns of the Indian Revenue; are you not aware that the general Revenue of India has in that period more than doubled ?—Yes, no doubt it has.

2636. So that the increase in the Tanjore district is not really larger in proportion than the increase of the whole Revenue of India ?—No. There has been a great increase of the Revenue of India by the annexation of Oude, and many other territories.

2637. But are you aware that in that period the price of grain throughout India has probably at least doubled ?—It has greatly increased.

2638. And that in those days the Madras land-revenue was calculated upon the price of grain ?—It was in Tanjore; not everywhere.

2639. And that therefore by a natural process the revenue would naturally be doubled by the increase in the price of grain ?—No.

2640. Why not ?—Because that is not the way that it has been carried out at all. The irrigated land in Tanjore pays exactly the same Revenue now that it did forty years ago; that is to say, the assessment per acre is the same as it was forty years ago.

2641. Then there could not be any increase of the land-revenue except by an increase of cultivation ?—Except by either an increase of cultivation, or an increase of irrigation; in no other way.

2642. Then if the Inspector-General of Irrigation, in stating that the old irrigated area was nearly as large as at present, is right; there would be no increase of land-revenue at all ?—No, none at all.

2643. Is not it possible that the irrigation, which was in a flourishing state when we first took the country, fell off afterwards, owing to the works falling into disrepair, was restored to its present state by the Engineers, and is it not possible that the discrepancy between Colonel Crofton's official statement and yours may be reconciled in that way ?—No. When I took charge of the Tanjore district there was no great falling off. People were terribly afraid of a great falling off, but there had no great falling off taken place at that

time. On the contrary, it had continually increased under our improvements. There was a considerable improvement in Tanjore before I took charge of it.

2644. Then, as I understand, the result of your statement is, that so far as direct profit in the shape of Revenue goes, there has been no increase of the land-revenue per acre in consequence of the improvements which we have made to the Cauvery irrigation, but that the improvement which you claim is due to the increase of irrigation which you claim, and so far contradicting the statement of Colonel Crofton?—The increase has been due to the greatly increased area of irrigation from which the Government have received the water-rate; that is the main cause of it, and that is the only thing which is carried to account in the Government statement.

2645. Now I will take you to Bengal, and to the comparison which you made between Bengal and Madras; I suppose you are aware that, for the purposes of that comparison, you selected the district of Bengal, which had been devastated by fever for several years, which was then in consequence in a very reduced state, and presented an unusually unfavourable picture, and which can hardly be taken as an average picture of the ordinary state of Bengal?—It, in a great measure, represents the state of a very large portion of the Bengal Presidency.

2646. And I think that the statements upon that subject which you submitted to the Committee, were entirely taken from the report of Colonel Haig, were they not?—And of Mr. Saunders, the Medical Inspector.

2647. You are aware that although Colonel Haig is a very admirable officer of the Madras Engineers, who, I think, was at one time your Assistant on the Godavery works, and an extremely able and conscientious man, he had no previous acquaintance with Bengal, that he was entirely ignorant of the Bengalee language, and that we can hardly accept his view of the social condition of Bengal as in itself and alone sufficient to supersede all other reports of people who have a greater knowledge of the country and the language?—I never saw any accounts of Bengal that contradicted his, and I have seen many.

2648. Then are you also aware that the complaint, with regard to the Burdwan and Hooghly district, was not that it had too little water, but that it had too much?—Both; that there was too much at one time of the year, and too little at another.

2649. I think Colonel Haig and Mr. Saunders entirely attributed the unhealthiness, although they attributed it to the question of water, to excess of water and not to deficiency?—No; a great portion of the sickness, he says, is due to their not having wholesome drinking water in the dry season.

2650. I think you stated that nothing was done in consequence of those reports?—No.

2651. Are you aware that notwithstanding that the sickness has disappeared?—I did not know that; I had not heard of it.

2652. Has your attention been drawn to a paragraph which went the round of the newspapers the other day, extracted from the official reports, showing that during the recent Madras famine those very districts of Hooghly and Burdwan had produced an enormous surplus of grain, that they were in a state of most exceptional prosperity, and that the surplus grain ready for export was so great, that the railway could not carry it away?—No. This is

what is described as the state of things as late as December 1877: "While fever is so prevalent in Calcutta, it seems also to be raging with some severity in many parts of the province. A correspondent draws a sad picture of the state of several villages not far from the metropolis, specifying Mitahari, Sharalia, and Sen'azgati. Fever, he says, has been raging there with the violence of an epidemic for a year and a half. He gives no statement of the mortality, but represents the people as quite heartless and hopeless. The native Kobirajes are baffled by the fever, and quinine, he says, is ineffectual. In their distress, the villagers are turning despairing eyes to the Government, wondering why a beneficent Râj does not send them medical aid. Another correspondent informs us that Halishahar has been suffering severely from epidemic fever since the middle of October. Application has been made by the inhabitants to the sub-divisional officer to move the proper authorities to send temporarily a medical officer and a supply of medicines to the place," and so on.

2653. That is certainly so; but I come back to my question: Are you aware that the Burdwan and Hooghly districts have recovered by the mere natural advance of the wave of fever into other districts, and that they have lately been supplying an immense surplus produce of grain which has been utilised for the benefit of the famine in the Madras districts?—Yes, I daresay they have.

2654. Are you aware that Hooghly and Burdwan are the most populous and most crowded districts of Bengal, and probably those which, in regard to the Revenue system, show the least favourably, and you will admit that there may be districts in East Bengal and elsewhere which may contrast not unfavourably with those of Madras?—No account that I have gives the slightest ground for supposing that it is a thriving population in Hooghly, but they are in a most miserable state. Every account that I have ever seen agrees with Colonel Haig and Mr. Saunders in that.

2655. Have you not also seen reports from which it may be drawn that in some districts of Eastern Bengal, where they are not so crowded, the population is really very prosperous and very well-to-do at the present moment?—I daresay there may be such a population.

2656. Have you not seen some extracts from statements of the present Lieutenant-Governor of Bengal, commenting upon the extreme prosperity of these districts of Eastern Bengal?—I have not.

2657. You will admit that there may be local circumstances which may affect one district, and not affect another?—Yes; and therefore I say, why were not the works executed that would correct those evils?

2658. I suppose you will also admit this, that it is not a necessary consequence of the fact that fever exists in some parts of Bengal, that irrigation works should be introduced into those parts of the country; that is to say, although your opinion may be that fever would be cured by irrigation works, yet it is not a thing which follows of itself as a logical and necessary consequence?—I only give my opinion, based upon Colonel Haig and Mr. Saunders' opinion, that is all.

2659. That is an evil which you believe would be cured by irrigation, but you cannot say that there is anything about it by which it can be proved logically that irrigation would necessarily cure that fever?—No; but that is the

opinion of Colonel Haig, Mr. Saunders, and myself, and we have had great experience.

2660. I will take now the Bengal district of Midnapore, in which irrigation has been introduced with some success; you are aware, are you not, that the supply of water for the Midnapore canal has been found to be extremely limited, and that in the dry seasons it has failed?—Yes, because they would not execute the works, and then we are charged with the want of water.

2661. What were those works?—Works for storing the water up the river; that is exactly the way that everything is done; all our works are spoilt, and then they turn round upon us and say, look and see how your projects have failed, and how the estimates have been exceeded; and I say, whose fault is it?

2662. What is your authority for saying that in this present year 270,000 acres have been watered by the Soane canal, because I find that in the last telegraph which has come from India, purporting to contain an extract from the *Gazette*, it says, "The last *Gazette* contains an important report on the irrigation works in Bengal for 1876-77;" "there is a considerable decrease in the area irrigated, which was 116,074 acres in 1875-76, but has fallen to 98,802 in 1876-77; this is attributable to the falling off in the areas on the Midnapore and Soane canal's area; the Orissa system shows a marked increase." What I want to know is, where you get the figures from which it appears that notwithstanding that in 1876-77 the total irrigation in Bengal had fallen off and was only 98,802 acres, at present there is irrigation upon the Soane of 276,000 acres?—The Governor of Bengal stated last September that there were 200,000 acres irrigated upon the Soane, and a private letter which I have received since then, stated that the extent of irrigation was 270,000 acres before the end of the year.

2663. Did he say so last September?—Yes.

2664. Did he say that they were irrigated, or that they would be irrigated? —That they were irrigated.

Mr. Fawcett.

2665. Have you got his speech?—Yes. He says, in November 1877, in the speech which he made upon the Soane works, "It also seemed to me fair, and I believe you will agree with me, if you will give the subject your unprejudiced consideration, that a share of the cost should fall on the people who directly benefit by the introduction of water to the neighbourhood of their fields, and are thus assured of a good crop at all seasons, instead of being exposed to the risk every few years of absolute failure. When I proposed this, I was told that the people did not want water; that they would sooner be left alone to bear the risk of famine; and I was even told that the water of the Soane was destructive to fields. Shortly after this discussion took place, the periodical rains were suspended, and then we had practical proof as to whether or not the Soane water was considered injurious or prejudicial. The people clamoured for water, and to meet this demand we were forced to open our unfinished canals, by means of which we have irrigated, during the last few months, 200,000 acres of land, which would otherwise have remained waste for the year, but which are now covered with luxuriant crops. The produce of this land represents food grain of the value of fifty lacks of rupees, and of this, crops to the value of forty lacks certainly would have been entirely lost

if it had not been for the supply of canal water, but it also represents the rent of the land, of which the landholder would have been otherwise deprived; and to this must be added the outlay which would fall on him if he had again to give relief to his tenantry in consequence of famine. I have just returned from visiting the part of the country where the system has been introduced. I saw, what every one admitted to be, the finest crops ever seen in Behar in the irrigated fields, while the unirrigated fields by their side were parched and had hardly a blade of vegetation in them. I drove for sixty miles through the irrigated tracts, and returned by one of the main canals. Nothing but this ocular demonstration could have convinced me of the enormous benefits which have been conferred upon the people by irrigation; and throughout the only complaints which I received from the people with whom I conversed, were of the non-extension of the water-supply to their villages."

Sir George Campbell.

2666. This was a speech made by Mr. Eden, when he proposed to introduce a compulsory water-cess upon the land, was it not?—No, that was not the subject of discussion at the time.

2667. I think the passage which you have read did distinctly refer to that? —He said it would be but fair that they should pay a part of it.

2668. There was a proposal to introduce a tax of that kind?—Yes.

2669. And that proposal has since been withdrawn?—Yes.

2670. Are you aware that this was the occasion on which, on account of the special failure of rain, the water was given gratis?—A great deal of it was, not half of it; I do not know what the extent was, but a large portion of it was paying.

2671. The greater part of this 200,000 acres was not paying, but the water was given gratis?—Not the greater part.

Mr. Onslow.

2672. There was nothing in that to prove that the natives would have taken the water if there had not been a scarcity?—No.

Sir George Campbell.

2673. Even if there was a scarcity in that year, they did not pay for it?—No, but the increase this year has been very great.

2674. Do you understand why, when there was a scarcity, they were not required to pay for the water?—I do not.

2675. I see you have contrasted the great advantage of river water in the way of manuring the land as compared to the deficiency of such qualities in rain water or well water; but is it not the case that almost the whole of the irrigation from the Ganges canal and from other canals of Northern India is by means of cold weather irrigation, a supply of water which does not carry fertilising manure with it?—I have no doubt that they carry down a great deal of fertilising manure, though not so much as when the river is in flood.

2676-77. Are you aware that the cultivators complain that it does not carry down any fertilising manure at all, but, according to their version, it is less fertilising than well water?—I am not sufficiently acquainted with the circumstances of the case, but they have gone on watering for twenty or thirty years, and I suppose they would not do it if they found that it was not beneficial.

2678. Is not that the very ground of complaint that has been made, that, owing to their watering for a considerable period, the land has been exhausted,

the water not having replaced what had been taken from the soil by exhaustion?—I do not think that cold weather water can possibly be so fertilising as flood water.

2679. It is the case, is it not, that the fertilising property of a number of rivers is only in the case of a river of a fertilising character when it is in flood, and when the water is drawn so directly from the river, and with so short a transit, that the silt is not deposited in the transit?—No; river water contains a large quantity of manure in chemical solution, and a large quantity in suspension. What is in a state of solution is carried wherever the water goes, and some of what is in a state of suspension is deposited, but it deposits the least fertilising part of it; and the most fertilising part is carried on with it to the fields.

2680. Is it not the case that the part which is actually in solution, being of a saline character, has sometimes been found to be defertilising?—I know nothing of that; I never saw fresh water carry salt myself, and, therefore, I do not know.

2681. I think you alluded to the fact that the poor were dying of starvation in the district of Cawnpore?—Yes.

2682. Is not that a district in which the Ganges canal is in full operation?—Yes, the Ganges canal waters 800,000 acres, but that will not supply the whole population of the Doab.

2683. So that at present this district is not protected from famine and scarcity by the Ganges canal?—Where the irrigation is they are protected; I do not say that it protects the districts which are not irrigated; there is only a small part of the Doab which is irrigated.

2684. I think you have quoted the petition of the Trichinopoly ryots?—Yes.

2685. Looking at the language of that petition, do you really believe that it was written by the Trichinopoly ryots, and not by a Madras lawyer?—I do not know, I am sure; it is a memorial that was made in the name of, and presented by, the Trichinopoly ryots; and this I do know, that it is exactly the language of the Trichinopoly ryots, because I know them well enough; I know it is exactly what they would say to anybody that asked them about the matter.

2686. Do you really think the language used in that document is such as a Trichinopoly ryot would use?—It may be put in English words by somebody, but it is perfectly certain that it is the sentiment of the Trichinopoly ryots; I know enough of them for that.

2687. You have expressed your opinion that in tolerably favourable circumstances irrigation may be established at a cost of from 2*l.* 10*s.* to 3*l.* 10*s.* an acre, and you say that at two and a half rupees per acre upon the expenditure of 3*l.* 10*s.* per acre, the return would be 8 per cent.?—Yes.

2688. Must not all the expenses for maintenance and establishments, and one thing and another, be deducted from that 8 per cent.?—Yes, 3 per cent. abundantly covers all the expenses connected with irrigation.

2689. Then that will reduce the return to about 5 per cent.?—Yes.

2690. Then that 5 per cent. will depend, first, upon your completing your irrigation schemes at a cost not exceeding 2*l.* 10*s.* or 3*l.* 10*s.* per acre; and secondly, upon the whole of the land covered by your irrigation canals being

taken up for irrigation, and the ryots of the whole of that land accepting the irrigation; and thirdly, upon their being willing to pay two and a half rupees per acre, good years and bad together, for the supply of the water?—Yes; it also supposes that the people will pay in that case one-eighth or one-tenth of what they are now paying for irrigating by wells. One of the witnesses stated that the expense of well irrigation was thirty rupees an acre; and Mr. Robertson states that, in Coimbatore, the expense of well irrigation is twenty rupees an acre, and therefore all that they pay is one-eighth or one-tenth of what they now pay for bad water from wells.

2691. Still you are aware that there are some districts in India which have not been willing to pay the two and a half rupees to produce 5 per cent.?—I am quite sure they would be extremely unwilling to pay half a rupee if they could possibly, by any means, evade it. They will tell all the stories in the world to the Revenue officer, and complain most bitterly of the Engineer, or do anything to try and find a way of evading paying altogether. In England, too, people would very much rather not pay the income tax than pay it if they could help it.

2692. Still there are districts in which they would rather refuse the water than pay even one rupee per acre?—Under some peculiar and extraordinary circumstances.

2693. Will you just point out generally what are the parts of India which you think are now most favourable to the extension of irrigation?—There is an enormous proportion of all India. There is all the Punjab, and all the remaining portion of the North-West, almost all of Oudh, all Rohilcund, all Bengal, all the Delta country, and all the plains of the Kistna and the Toombudra, and the vast extent of the Carnatic still unirrigated, many hundred millions of acres perfectly fit for irrigation.

2694. Still you will admit that it is more likely to be favourably regarded in some parts of the country than others?—Yes; you must examine every individual project of course.

2695. So that your calculation, that people will be willing to pay two and a half rupees per acre, would not apply to all districts?—No; but two and a half rupees is so extremely low, that I am quite sure that there is no part of India where it would not be worth while their paying that. The charge on the Toombudra is six rupees per acre.

Mr. Ernest Noel.

2696. In well irrigation the sole cost to the ryot is his own labour, is it not?—And his bullock labour.

2697. But would not he give that labour when he would be otherwise doing nothing, and therefore it becomes practically no cost to him?—The principal part of the demand for water is in the very height of the cultivating season, when labour is wanted for every purpose.

2698. You gave an estimate of 3,000*l*. a mile for making a canal; would that be for a steam-boat canal?—Yes.

2699. Because a steam-boat canal is very much more costly, is it not, than one on which steam is not going to be used?—Yes; I am speaking of first class canals fitted for the immense traffic of India, which must necessarily be large enough for a steamer.

2700. Would you not have to protect the banks in some way from the wash of the steamer?—You would either have to slope the banks or to line them with stone. In the very large canals, such as the Sirhind canal, 110 yards broad, the wash is a mere nothing. I would like to add one more remark to that, namely, that the great mass of the traffic going at the very low speed that it would necessarily do, there would be no wash at all.

2701. In England the objection to canal traffic is the slowness of carriage. I suppose you consider that in India time is not so important as in countries like England or France?—Time is, of course, a very secondary thing in a poor country compared to what it is in a wealthy one; but when I see, I do not know how many lines of navigation in England, with a million and more tons on it, it shows that there is a large portion of traffic to which time is of very little consequence indeed. Only think of nine-tenths of the traffic from Goalundo to Calcutta taking six weeks, carried on by European merchants, while it can be brought by railway in a day; that is a proof what the value of time is in the great mass of the traffic.

Mr. Childers.

2702. Have you formed a complete scheme for navigation and irrigation canals for the whole of India, which you would recommend that the Government should carry out over a series of years?—As to navigation canals, I have a complete scheme of the main lines in my head; as for the irrigation plans, they would require to be examined in detail.

2703. But could you give the Committee approximately the extent of the scheme which you have either in your head, or which you have prepared on paper?—The first thing of all that I would do would be to give about 10,000 miles of main line navigation, which I reckon would cost about 30,000,000*l.*

2704. You would first of all take 10,000 miles of main navigation; then do you add to that any lateral navigation?—That might be carried out to any extent afterwards.

2705. But in proposing a great plan for the adoption of the Government, have you arrived at anything approaching to figures as to the extent to which that scheme would go; added to the 10,000 miles of navigation, could you give an estimate of the ultimate mileage of the lateral navigations?—No, that might be carried out to any extent whatever; for instance, we have now, in the little Delta of the Godavery, already 500 miles of navigation.

2706. Passing from navigation for a moment to irrigation, how many millions of acres do you estimate should be dealt with by canals, which would be irrigation, and not navigation canals?—I would make all the main lines of irrigation navigable; there is nothing but the very small branches of irrigation canals that I would not make navigable.

2707. Are we to understand you, therefore, to say that all you have as yet in your mind is 10,000 miles of canal?—Of main canal.

2708. But can you give us no approximate estimate of what extent of subordinate canal, whether navigable or not, would be necessary feeders to those 10,000 miles?—I do not say that they would be necessary feeders, because I say that those great lines would carry an immense proportion of the navigation, but every additional branch that you make would increase the traffic on the main line.

2709. How many acres would the main lines deal with?—They would deal with by far the greater part of the more populous country of India.

2710. Could you give us it roughly in millions of acres?—The total area of India is 1,500,000 square miles, and 10,000 miles, with a border of 100 miles, fifty miles on each side, would then be a million square miles.

2711. Then do I correctly understand you that two-thirds of the land of India requiring to be irrigated would be so irrigated, by 10,000 square miles of navigable canal?—No, I do not think I could say that. A great portion of the canals that I am now mentioning, would only irrigate to a small extent, or not at all; some lines would not irrigate at all.

2712. I want to have from you, if you please, the total amount of acreage requiring, in your judgment, to be irrigated, which your scheme deals with, and I want to know how many miles of canal, whether navigable, or for irrigation purposes only, would be required for it?—An enormous extent. We have 500 miles of considerable canal in Godavery for the irrigation of a million acres, and that system has besides 2,000 or 3,000 miles of branch canal. The total extent of branch canals is prodigious.

2713. But I want to know so that it may be on the records of the Committee, how much of that prodigious quantity may be estimated at in figures? —The total land of India, as I say, is 1,500,000 square miles; supposing we irrigated out of all that at present one-fifth, that would be 300,000 square miles, and that would be 150,000,000 acres.

2714. And for that 150,000,000 acres how many miles of canal would be required?—It would require an enormous amount. That 150,000,000 acres would require 450,000,000*l*. or 500,000,000*l*. sterling to irrigate it all.

2715. And it would only deal with one-fifth of the quantity which you would propose to the Government to irrigate?—No, it would be one-fifth of all India.

2716. What proportion of the acreage, which you propose to irrigate, would be met by that first scheme?—I would propose it as an extensive system of irrigation; I would not lay down any precise quantity to begin with. I consider that every million acres that you irrigate is an immense point gained, and that would be combined with navigation; but I would not lay it down definitely.

2717. I want to know what the total scheme would be; that is to say, what is your idea of what the Government should work up to as the total scheme of irrigation?—The scheme I proposed in my last examination was, to begin with, that they should spend ten millions a year for ten years, and they might go on with it as long as they liked.

2718. How much of the total amount of land which you think should be dealt with would that provide for?—They might go on extending it to anything; there is no limit to it.

2719. Forgive me, that is no answer to my question. I want to know what is, in your opinion, as a matter of policy, the total scheme which the Government should have ultimately in view, when working upon this great plan; how many millions of acres do you think should be irrigated, either by navigation canals, which are also irrigation canals, or by irrigation works only, and up to which you think that over a series of years the Government should

work. I want the total of it all?—If they go on at 10,000,000*l*. a year, it would go on for fifty years; I have no limit to it whatever.

2720. May we take it as your answer that you propose that the Government should, over 100 years, spend 10,000,000*l*. a year?—Yes, certainly.

2721. That is a thousand millions altogether?—Yes, I have no objection whatever to their doing that; I am sure India requires it.

2722. You are before the Committee as the proposer of a great scheme, and I want to know the limits of the scheme. May we understand that you propose to the Government the adoption of a plan under which, for 100 years, 10,000,000*l*. a year would be spent in irrigation works?—Yes, I know of no reason why they should not; but if you insist upon my limiting it, I will say 10,000,000*l*. a year for twenty years, that is, 200,000,000*l*.

2723. Supposing that is done, at the end of twenty years what shall we have effected?—We should have for the 200,000,000*l*. about seventy millions of acres irrigated.

2724. But what would be the position of the rest of the land which required to be irrigated?—It would be just the same as it is now.

2725. In your judgment, I presume that would be in a very unsatisfactory position?—It would be just in the position of the unirrigated land now. A great deal of unirrigated land is in a very satisfactory state.

2726. The scheme which you recommend to the Government of this country and the Government of India to carry out, is a very great scheme; can you give us the limits of the scheme?—I give you as a limit ten millions a year for twenty years, 200,000,000*l*.

2727. If the Government would spend ten millions a year for twenty years, and stopped then, would you be satisfied?—I do not say that I should be satisfied. What might occur before the Government had done that, I do not know.

2728. Therefore, having regard to the present state of things, and without any knowledge of what the future development may be, you would be satisfied with dealing with one-fifth of the land of India which ought to be treated with irrigation works?—I do not venture to say that I would be satisfied; nothing would satisfy me. I would never stop till everything had been done that could be done; and everything you do opens the way for something more. What is impracticable or unadvisable now becomes perfectly practicable and advisable when you have taken certain steps in advance.

2729. When you had expended 200,000,000*l*., would you not have left a large quantity of country still, in your judgment, at the present time requiring to be dealt with, but not dealt with?—I might or might not; I do not know.

2730. Is your mind in so vague a condition as to that, that you could not say distinctly?—I do not know how far it might be advisable to extend it.

2731. May we take it that 200,000,000*l*., as far as you have formed a complete judgment, is the amount which we have to provide for?—Yes, I think it would be very wise to keep that in view.

2732. What would be the total mileage of irrigation and navigable canals for which that would provide?—I think it would irrigate seventy million acres,

and as the rule is that for every million acres there would be 500 miles of navigable canal—not of main canal, but navigable canal,—it would be 35,000 miles.

2733. That would be 35,000 miles of navigable canal; in addition to that, how many miles of irrigation, non-navigable, would be within the scheme?—I could not say at this moment; but certainly it would be 2,000 miles for the 700,000 acres in the Godavery.

2734. Leaving that part of it uncertain, you would at least have to carry out 35,000 miles of navigable canal, and whatever ought to be the proportionate mileage of irrigation canal, in twenty years; under whose supervision would those extensive works be carried out?—That is not my business; I do not undertake that part of the business; I undertake the Engineering part of the question.

2735. To whom would you give the execution of those large works?—To the Engineer of course.

2736. To the Indian Public Works Department?—Yes, of course.

2737. You would entrust the expenditure during the next twenty years of 200,000,000*l.* sterling to the Indian Public Works Department?—Yes, certainly.

2738. And you would make them responsible for carrying out this great scheme?—Certainly, under the Governors.

2739. How do you propose that the money should be raised?—That is not my business.

2740. As the promoters of this great scheme, how would you raise the money?—I should not raise it; I know nothing about finances. I would not recommend anything I know nothing about; I am not a financier, I am an Engineer.

Mr. Onslow.

2741. Would not the getting of the money be rather an important portion of your scheme?—It is not an Engineer's business to raise money. The railway Engineers did not raise the 170,000,000*l.*, it was the Government did it.

Mr. Childers.

2742. I am only asking you questions as to your plan; you do not give any advice, then, as to the manner of raising the money? No, I do not.

2743. How would you recommend that the interest on this large Capital should be charged during the construction of the works when they are not remunerative; should it be added to the amount borrowed?—Yes, certainly; that is a proper part of the cost of the works.

2744. Then it should not, you think, be charged during construction against the Revenues of India?—No, of course it is part of the sunk Capital in executing the work. Nothing can be more proper than that. If I am asked what would such a work cost, I would say the Engineering cost of the work we will suppose is a million, and supposing it takes five years to execute, at 4 per cent. Government interest, there is an accumulation of 10 per cent. in addition; that is to say, the actual cost of the works would be 1,100,000*l.*

2745. When you have spoken of 200,000,000*l.*, have you included in that the interest during construction?—No, I did not, when I made that rough estimate, include the accumulation of interest.

2746. During how many years from the commencement of the construction of such work and the commencement of raising the money, do you think it would not be remunerative, or, in other words, how soon would it become remunerative?—It is very different in different parts. Our Godavery works made a return the very first year that they began. Other works have been three or four years before they made a return; and some, through this dreadful mismanagement, like the Toombudra works and the Orissa works, have not paid for ten years.

2747. How many years would you take as a fair average?—I should think, as matters are, allowing for all mistakes and everything, you might, with perfect safety say, that they would be paying a fair return in ten years from the time of beginning; that is, you would have to charge five years' interest.

2748. How would you charge the five years' interest; you say 20 per cent. in addition to the 200,000,000*l.*?—Yes.

2749. That makes, does it not, 240,000,000*l.*?—Yes, that would be a proper part of the expense.

2750. What net income do you hope to derive from those works when they are in fair swing after the ten years as against the 240,000,000*l.* at which their construction must be taken?—It would be very various in different places. Some would be more successful than others; no doubt there would be some failures still, and some great successes probably. But what I wish them to yield would be the Government interest of money.

2751. What do you expect them to yield?—I should say they would certainly yield 7 or 8 per cent. if they were tolerably well managed, taking them all round.

2752. Four per cent. on 240,000,000*l.* would just amount to 10,000,000*l.* a year; as you anticipate that those works will yield, and as you recommend them to the Government on the ground that they will yield a net income of ten millions a year?—Yes, I can safely do that.

2753. In calculating that, have you allowed fully for repairs and renewal and for inevitable improvements?—Yes.

2754. How much have you allowed for that?—Three per cent. upon the primary cost is what we have ascertained to be sufficient for the management and repair of irrigation works.

2755. I am speaking only now of repairs and renewals, and what are called inevitable improvements, namely, the sort of improvements that you cannot charge to Capital; how much a year do you expect would have to be spent on purposes of that kind?—Three per cent. on the Capital.

2756. That is a little over seven millions a year?—Ultimately 6,000,000*l.*, 3 per cent. on the cost 200,000,000*l.*

2757. After the canals have been brought into complete and active operation, who do you propose should manage them as a matter of business?—Who manages the railways? It is just the same. You have 170,000,000*l.* sunk in railways, and you have no trouble about finding management for them.

2758. The railways are managed, the greater part of them, say three-fourths, by large Companies; do you propose, as I understand your answer, that those canals are to be managed by large Companies?—No, I am supposing all of them under the Government. I see no objection myself to Companies being employed upon them, but I am supposing that they were under Government.

2759. You are the author of a great scheme, and we want to know exactly what your view is as to how it is to be carried out, and it is very material to know who should manage them; and what I should be glad if you would tell me is this, after those canals had become matters of business, works intended to be remunerative and to attract business for navigation purposes, and to be well administered for irrigation purposes, who would you recommend should be the persons to undertake this business operation?—The head of the Public Works Department, of course.

2760. What extent of *personnel* do you think would be required to manage such works?—I have nothing to do with that; I have no opinion about it; I never think about it.

2761. Have you thought of the number of persons who would be required?—No; I have nothing to do with that at all.

2762. Or what the cost would be?—No.

2763. Or how they should be appointed?—No.

2764. Or under whose business management they should be placed?—I have nothing in the world to do with that; I am an Engineer; that is a matter for Statesmen, and Governors, and Commissioners.

2765. Do not you think that the prospect of good management of the works which the Government is going to undertake is an important element?—Yes, of course.

2766. But you have not thought about it?—No, it is not my business; I have nothing to do with that.

2767. At the same time you think, speaking generally, that those should be Government establishments rather than private ones?—I do not know that I would say that; I should have no objection myself to employing Companies. There are certain reasons for employing them in my mind, and certain reasons against them; but I should be more inclined, I think, to do them by means of Government.

2768. If they were done by means of Government, would you place those establishments under the Central Government direction or under the Presidents or Local Governments?—I must beg to say that all these are entirely out of my line. I am not a Statesman or a man of business. I am an Engineer, and, therefore, I have no opinions on these matters. If I am asked, I have certain floating ideas about them; I would give much more liberty to the Local Governments than they have at present. I would have much less interference on the part of the Supreme Government with the Local Governments. I see now that one misjudging Viceroy can paralyse all India. If the several subordinate Governors and Commissioners were more independent, then the more energetic amongst them would carry out the improvement of the country, and would not be prevented from doing it by an inefficient Viceroy.

2769. Although you have not thought out the question of Government management, you tend rather to local than to central supervision ?—Yes, to a certain extent. Of course there must be that central supervision.

2770. And if this great plan is adopted for canals, involving 200,000,000*l.* being raised in the next twenty years, what do you recommend that the Government should do about railway construction ?—I would stop the railway construction entirely, except in places where they are essential, and where you cannot make a canal. It is a dreadful perversion of the public funds.

2771. In places where you cannot make a canal, you would, however, proceed with the present system ?—There might be some few spots, but they would be very few.

2772. You will kindly remember that you are only dealing now with one-fifth of the country, which you think might well be the subject of canals ?—With one-fifth of the area, but the canals would run through the whole country, of course.

2773. Where there are no main navigable canals, and where, from motives of economy or others, you do not carry out the whole of your scheme, on the sides of those canals would you construct railways there ?—No, only where you could not carry a canal cheaper and carry cheaper. My position is this, that a railway is dearer, and railway-carriage is dearer. The railway cannot carry the quantity you want, and the railway is indefensible in a case of disturbance, so that there is every reason for preferring a canal to a railway.

2774. I have read with great attention your evidence, and I quite understand your view upon it, and I am only examining you now upon what you just now said; you said that, although you think that canals ought to be executed to supply 1,000,000 out of 1,500,000 square miles in India, you would only, during the next twenty years, provide for 200,000 square miles. What I wanted to ask was this, whether with respect to the remaining 800,000 square miles you would employ the agency of railways at all, or whether you would do without them altogether ?—Only in places where you could not cut lines of canal, nowhere else.

2775. But you only propose the employment of canals with regard to 200,000 miles ?—But they would go through all the main lines of country. How far you would extend the branch canals to pervade the districts adjoining them is another question. Only I say that I would never make a railway where I could make a canal cheaper, and to carry cheaper.

2776. Still I must deal with your scheme as a whole; you only wish to apply your scheme to one-fifth of the area, to which you consider it applicable; what I want to know is this, as to the remaining four-fifths of the area, would you do nothing, or would you construct, to any extent, railways ?—No. If further communication were wanted, I would cut canals, except where you could not make a canal.

2777. That would cost money, would it not ?—Yes.

2778. In addition to that 200,000 miles ?—Yes.

2779. How would that be provided for ?—In the same way as the others, if you went on with it.

2780. Then it comes to this, that 240,000,000*l.* does not really describe what you would spend within the next twenty years; but you would wish to

spend a great deal more?—I do not say how much I would wish to spend; but I say that that would provide an immense network of canal water-carriage throughout the whole of India. It would not minutely pervade the country, but it would bring water-carriage within a moderate distance of every portion of the populous part of India.

2781. I am afraid we cannot therefore ask you to go beyond that; but you think a million square miles ought to be dealt with, and could be profitably dealt with?—I did not say a million, I took one-fifth of the area.

2782. Do we understand that 1,200,000 miles could be satisfactorily dealt with by canals?—I do not know, I am sure, to what extent they could be carried.

2783. What I understood you to say (and if I have not understood it correctly, pray put me right) was, that the whole of India was a million and a half square miles, but that about half a million square miles could not be touched by canals at all, that of the remaining part you would deal with about one-fifth, and that one-fifth would cost 200,000,000*l.* sterling in the next twenty years, besides 40,000,000*l.* sterling for interest during construction?—Something like that.

2784. What I was asking you now was this, as to the remaining part of that million square miles, would you leave it alone during the twenty years, or would you make any railways, and so forth, there?—No, I would not make railways.

2785. You would make no railways over that million square miles?—No, unless you could not make a canal.

2786. And you would only carry out any extension of the railway policy over that, roughly speaking, half a million (or it may be more) square miles, where canals cannot be carried?—Yes.